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ARCHIVES
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OTOLOGY

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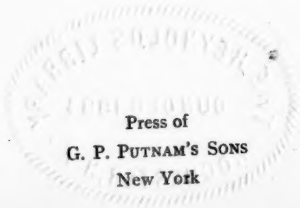
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ARCHIVES OF OTOLOGY.

ON THE POSITION OF REISSNER'S MEMBRANE
IN THE HUMAN COCHLEA.

By H. STEINBRÜGGE, IN HEIDELBERG.

Translated by Dr. M. L. KING, New York.

(With two wood-cuts.)

A PECULIAR and not heretofore-described condition of the labyrinth, which I found in a woman thirty-four years of age, who died of tuberculosis, caused a revision of all my old preparations, and the making of new ones, of the human cochlea. The results of the investigation will here only be given in so far as they pertain to Reissner's membrane.

In the anterior lower wall of the left utricle, at the level of the lower margin of the fenestra ovalis, an elliptical perforation was found, the measurements of which were $1 \times 1\frac{1}{2}$ mm.

That this opening was not an artificial one is tolerably certain, as its edges were as smooth and regular as we often find them in perforations of the drum-membrane, and it was seen as soon as the vestibule was opened. In the examination the vestibule was, moreover, opened from the direction of the cochlea by means of thin sections, which were vertical to the long axis of the pyramid. This, then, constituted a communication between the peri- and endo-lymphatic spaces, which probably existed during life. As the patient from whom the preparation was made had died some time previously, in the hospital of a large city, and data as to any aural disease were not to be had, and as the microscopic preparations failed to show the cause of such a circumscribed destruction of the sacculus vestibuli, the opening found

would not have been worth mentioning, if it had not been accompanied by another pathological condition which was also rare.

In the cochlea of the same side, particularly in the second and third turns, there was a considerable deposit of

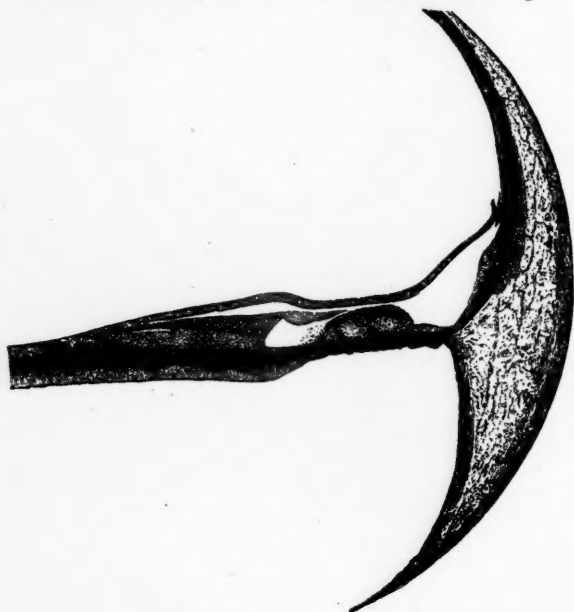


FIG. 1.



FIG. 2.

hæmoglobin, and great dilatation of the vessels, which had ruptured at several places, causing extravasations of blood; besides this, there was a peculiar condition of Reissner's membrane which is shown in the accompanying cuts.

As is plainly seen, Reissner's membrane (vestibular wall, according to Reichert; *membrana vestibularis*, according to Henle) does not pass in a straight line to the outer wall of the ductus cochlearis, formed by the *ligamentum spirale*, but rests on the *membrana tectoria*, covers also Corti's organ, and then gradually passes upward to its point of attachment, so that of the ductus cochlearis only a small space remains. This condition was constant in all the sections, and could also be seen in the cochlea itself by means of a lens.¹

In sections from the beginning of the cochlea only did this vestibular wall appear to pass directly to the outer wall of the cochlea; this conclusion being based on a combination of several fragments, varying in size, of this part. The second cut is intended to show that this membrane becomes agglutinated to the organ of Corti, or, rather, to the *membrana reticularis*.

From this cut we see, that during the process of cutting the sections, the *lamina spiralis membranacea* was torn off; the outer part, with the organ of Corti upon it, being dislocated. Notwithstanding this, the small piece of Reissner's membrane lying on the latter remained attached to it, thus showing how closely the two were connected. Reissner's membrane was also torn.

It was, therefore, very natural to assume this condition to be pathological, and to connect it with the perforation of the utricle. If there had really been a draining off of the endolymph, the collapse of Reissner's membrane is easily explained, provided it was not in a state of tension, but rather in a relaxed condition; and provided, further, that the perilymph passing in through the perforation did not exert a pressure equal to that of the fluid of the same name in the *scala vestibuli* exclusive of the ductus cochlearis.²

It therefore seemed necessary to test the relative pressure exerted by fluids separated by membranes in the same, or, at least, in a similar, manner as are the peri- and endo-

¹ This should be noted, as it proves that the depression seen in the specimens was not made by the section-cutter, as might be supposed.

² Because of the tension and partial fixation of its walls, the utricle had not collapsed, but retained its normal shape.

lymph. For this purpose a piece of the ileum, tied at both ends, and distended with water, was submerged and then incised. Even when this was done at the bottom of a deep vessel, under the pressure of a considerable column of fluid, it was found that after a time the gut collapsed, thus showing that its contents were evacuated, and that the fluid passing in it was not able to counterbalance the pressure on the outside of the gut. One can, moreover, easily convince himself that a piece of intestine, tied at one end, and held open by means of two fingers at the other, and then placed under water, will become only partly filled. To distend this intestine under such conditions, water must be poured into it.

The result of this experiment seems, then, to favor the assumption, that on opening membranous structures containing endolymph, their contents must drain off, and their walls collapse, unless they are able, by means of their ligamentous connection, or their own consistency, to withstand the pressure of the perilymph.

We would seem, therefore, to be justified in assuming that, in the present case, there was a draining off of the endolymph, and that Reissner's membrane sank down on the membrana tectoria and the organ of Corti, in consequence of an excessive pathological stretching or relaxation. It even seemed that this coming in contact had resulted in a growing together of the two structures.

The probability of a pathological change in the vestibular membrane is increased by the fact, that considerable quantities of old pigment were found in parallel sections of this same membrane.

Furthermore, if the sinking down and agglutination of this membrane had taken place during life, the function of the organ of Corti, as well as of the membrana tectoria, must have been thereby impaired.

A re-examination, made for the purpose of comparison, of all the vertical sections of the cochlea at my disposal, showed, however, that the above-described condition of Reissner's membrane is not very rarely found in the cochlea of the human adult. But it is easily overlooked,

especially when this membrane is lying closely upon the organ of Corti, and if it—as happens in most cases—is torn and only fragments of it are found in the section. This same condition of the membrane was also seen in sections prepared from the cochlea of another person who had died of tuberculosis, and it, therefore, seems doubtful whether a relaxation of Reissner's membrane, such as we have described, is to be regarded as pathological.

From the descriptions and cuts in the text-books we certainly are accustomed to picture to ourselves the vestibular membrane and vertical sections of the cochlea, as passing at an angle of about 45° in a perfectly straight line from the crista spiralis to the ligamentum spirale. But it must be remembered that most of these investigations have been made on the cochlea of young animals or embryos; the petrous bone of infants has been but seldom, and in most investigations the cochlea of the human adult has been even less frequently, studied in microscopic sections, as the decalcification of the bone is more difficult and involves the loss of much time; the cochlea of the adult is, moreover, less adapted for the demonstration of normal histology. Even the most expert and careful histologists are seldom successful in preserving Reissner's membrane intact, in vertical sections, because of its fragility; complete drawings of the same, if they are not simple diagrams but have been copied from nature, represent almost exclusively embryonal preparations. We do not possess, so far as I know, an authentic drawing, representing the cochlea of the human adult.

We must not forget, furthermore, that all the preparations used in such investigation, even those of embryos, have been treated with hardening agents, such as osmic acid, chloride of palladium, Müller's fluid, chromic acid, and strong alcohol, in order to make them suitable for cutting. Such treatment must, of course, make it much more difficult to form an opinion as to the actual condition, and the degree of tension, of delicate membranes during life. The

question therefore arises: Is Reissner's membrane during life in the same position in which it is seen in prepared specimens? This is a question of much physiological importance, and is of particular interest in regard to the human cochlea.

The definite solution of this question as regards the human cochlea, is rendered still more difficult by the fact that the petrous bones are almost without exception, removed only several days after the death of the individual, during which time the cochlea undergoes maceration, after which it must be exposed to the action of the reagents and acids above enumerated. It may be possible, however, to form a conjecture as to the shape of the ductus cochlearis during life by comparing a large number of preparations of human cochleæ. We find, for instance, that the membrana vestibularis is sometimes very tense, and again in a condition of total relaxation; and between these two conditions many gradations are found. These variations are seen not only in different cochleæ, but are even observed in the same one, as in the case described, in which the beginning of the first turn was quite different as regards the membrana vestibularis, from parts lying farther toward the apex. Besides this the fragments of the torn Reissner's membrane sometimes assume a curved shape, or even curl themselves up, and the last-named property seems to me to be of particular importance, as indicating a state of elasticity or contractility of this membrane, which is also mentioned by other observers.¹

If the elasticity of this membrane is acknowledged, the conclusion seems permissible, that in the human cochlea, a post-mortem relaxation of the membrana vestibularis,

¹I wish here to call attention to a probably not well-known remark of Reichert, referring to this point, found in his work, "Beitrag zur feineren Anatomie der Gehörschnecke des Menschen," etc., on page 12 of *Abhandlungen der Königl. Acad. der Wissenschaften*, Berlin, 1846. It is as follows: "If we also consider that the membranous cochlea is filled with fluid, and that at present it is impossible to obtain this canal, filled with and expanded by its normal contents, for examination, and that the shape of the very elastic vestibular membrane which is fastened to the walls, will probably vary greatly according to the quantity of fluid contained in it, it will be the duty of the anatomist when describing the special outer form of the membranous canal of the cochlea to call attention to the deviations of the shape caused by the condition of the vestibular membrane."

a loss of elasticity, occurs in some instances, while in others it may be wanting, or is present in a less degree ; we may even assume that these variations may occur in different parts of the same cochlea. Now, since in the removal of the temporal bone from the cranium, and the tearing off of the dura mater from the posterior surface of the pyramid surface, the aqueductus vestibuli is always opened, the endolymph can escape, and those parts of Reissner's membrane which have lost their elasticity will then collapse, and cause a narrowing of the ductus cochlearis, as is seen in the two drawings.

It is very natural to connect the loss of elasticity of the membrane with the disease causing death, the more so if the disease has been protracted and of an exhausting nature, and signs of congestion are found in the cochlea. As has already been mentioned, some of the preparations in which Reissner's membrane showed this peculiar condition, were taken from persons who died of tuberculosis. On the other hand, the same condition was found in the cochlea of a woman who died of pleurisy, and in a male suicide, thirty-one years of age, who bled to death from an incised wound in the neck. In the last case especially, it seems improbable that the relaxation of the membrane was due to pathological changes ; it can have been caused only by post-mortem changes:

While further investigations will be necessary for clearing up these intricate conditions, the fact that such changes in Reissner's membrane as have been described may be within the range of the normal state, may, for the present, be a not unwelcome hint to all who are engaged in the investigation of the pathological changes in the human cochlea.

If, moreover, the supposed elasticity of the membrane should be confirmed—and this seems quite probable,—then the form of the ductus cochlearis during life could only be of the triangular, prismatic shape shown in text-books, if the pressure exerted by the endolymph *exactly equalled* that of the perilymph. Under all other conditions Reissner's membrane would be curved and its convex sur-

face be turned to the scala vestibuli or to the ductus cochlearis, according to the preponderance of pressure of the fluids. The first will usually be the case, because the endolymphatic space is shut off, while the perilymph can flow out through the aqueductus cochleæ. It might even be imagined that the elasticity of Reissner's membrane acted, to a certain extent, as a safety-valve, by preventing too great a pressure in the endolymphatic space, be it caused by congestion, increased secretion, or by pressure on the cul-de-sac of the aqueductus vestibuli situated between the layers of the dura mater. The necessity for the exact regulation of the pressure in the ductus cochlearis is at once apparent, if we remember that any increase in it will change the tension of the cord of the *zona pectinata*, and thereby alter its pitch.

Whether an excessive diminution in the pressure of the endolymph can occur, except in the rare cases of perforation of the membranous labyrinth, must remain undetermined for the present.

From what has been said above, the effects of such a decrease of tension can easily be construed.

SUPPLEMENT (published three months later).

Since publishing the above communication several other observations have been made in regard to the configuration of the ductus cochlearis in man, which seem to support the views there expressed as to the shape of this duct in the living subject.

In regard to the tension of Reissner's membrane much difference was found in various parts of one and the same cochlea, the tension ranging from that of the highest degree to total relaxation.

This fact, and the circumstance that the free edge of pieces of this membrane often appear curved or curled up, I regard as additional support for the assertion made by other authors, that this membrane is elastic during life, and that after death it may or may not lose this property. This elasticity seemed, moreover, to afford to a certain extent protection against excessive variations in pressure in the completely shut-in endolymph.

In the cochlea of a child who died of diphtheria (see paper by Moos, and by the author, in these ARCHIVES, vol. xii., p. 255) there was an unusual coagulation of the endolymph, as well as the perilymph, thus giving to the canals of this cochlea an appearance as if they had been artificially injected. Whether this coagulation occurred during life or during the death-struggle, or whether it was caused by the reagents used in preparing the specimen, could not be determined. Under these circumstances, at all events, a draining off of the endolymph was impossible, and Reissner's membrane was thus fixed in its normal position. The coagulated lymph was so firm that in many of the sections made for microscopic examination, it was preserved entire or in part. Examination of the latter confirmed the opinion expressed above,—that in cases of unequal pressure in the endo- and peri-lymphatic spaces, Reissner's membrane will bulge either toward the scala vestibuli or the ductus cochlearis. In this case, the convexity of the membrane was turned toward the scala vestibuli, thus showing that the pressure in the ductus cochlearis had been greater than that in the perilymphatic space. Even in specimens in which the coagulum and Reissner's membrane were only partially preserved, the former position of the membrane could be recognized by the concave edge of the coagulated lymph remaining in the scala vestibuli.

In the cochlea of another child, who also died of diphtheria, the uncoagulated endolymph had probably escaped, because in this case Reissner's membrane had sunk down in a remarkable degree. It completely covered in all the turns the organ of Corti, the membrana basilaris, and the ligamentum spirale up to their insertion, so that nothing remained of the lumen of the ductus cochlearis, and on a superficial examination the presence of the ventricular membrane might have been readily overlooked.

In regard to this relaxation of the membrane of Reissner, it should be stated, that it was previously observed by Hensen, who described it in the paper: "*Zur Morphologie der Schnecke des Menschen und der Säugethiere.*"¹

¹ *Zeitschrift f. wissenschaftl. Zoologie*, von Siebold und Kölliker. Band xiii.

The paragraph in question, in which the author also gives the size of the angle formed by Reissner's membrane with the crista, is as follows: "It (*i. e.*, Reissner's membrane) passes upward and outward from the crista spiralis, at an angle of 15° in man, and 40° in the sheep, to connect itself with the ligamentum spirale above the stria vascularis. It is strange that, in man, Reissner's membrane diverges so little from the membrana basilaris. The delicacy of the membrane (0.005 mm.) is so great that it could easily be in some relation to the vibrations of sound, but in regard to this I would remark that this membrane *need not necessarily be in a state of great tension*, as, for instance, the distance between its points of origin and attachment measured only 0.825 mm., while its width was 0.9 mm. I have, moreover, convinced myself by the inspection of fresh specimens *in situ* that the membrane is in a state of relaxation. *Still, it is possible that it is kept tense by the endolymph, which, in all my specimens, had escaped.*"

The supposition, expressed by the above author, in the last sentence quoted, is supported by the condition of Reissner's membrane found in the specimen mentioned above, in which coagulated lymph filled the canals of the cochlea.

Even the statements as to the course of Reissner's membrane, which do not agree with Hensen's description, made by later investigations of the cochlea, may all be reconciled by assuming, that while Reissner's membrane, during life, is elastic and curved more or less by the pressure of the endolymph, IN PREPARATIONS it usually appears quite tense, but sometimes also folded or totally collapsed, in consequence of the loss of elasticity.

As briefly as possible, I will give the views expressed in several prominent works on the cochlea.

As far as I know, Löwenberg and Rosenberg are the only ones who mention an arched position of the membrana vestibularis. Löwenberg opposes the opinion of Kölliker that Reissner's membrane has about the same inclination to neighboring parts in all the turns of the cochlea, and says: "The nearer we approach the base of the cochlea the less acute is the angle formed by the membrana

vestibularis with the basilar membrane, and the less obtuse is the angle which it forms with the stria vascularis." He also says: "In ascending toward the apex of the cochlea it becomes less distinct, becomes more and more rounded, and at the last turn is replaced by a moderately shallow arch. In older embryos this phenomenon becomes more marked, indications of it being found already in the lower turns." These observations were made on preparations of the cochlea of pig embryos about three inches in length. In connection herewith it may be mentioned that Boettcher (*über Entwicklung und Bau des Gehörlabyrinthes*), in fig. 24, A, plate vi., represents the vestibular membrane as slightly curved, while in other plates of the same work it is shown as a more or less straight line. (Fig. 24 was taken from a cat embryo about 9 *cm.* in length.)

Kölliker: "The membrane is tense, and passes in a more or less slanting direction across to the outer wall of the cochlea to become attached to the periosteum."

Middendorp: "The wall of the scala vestibuli, which in its natural condition is in a state of tension," etc. Also: "Hensen's measurements of the inner or central angle of the membranous cochlea are of no value,—because this angle varies according to the height of the membranous cochlea."

Winiwarter: "As is acknowledged by all observers, the angle which it forms with the lamina spiralis, continually decreases as we pass from the beginning to the apex of the cochlea." Also: "I have sometimes, particularly in the upper parts of the cochlea of the guinea-pig, seen Reissner's membrane pass over the whole upper lip of the lamina spiralis, passing across from this point to its attachment under some tension."

Henle: "On section the ductus cochlearis is triangular, bordered by three walls," etc. Also: "The walls diverging from the lamina spiralis are membranous, and in the natural condition are tense, and therefore flat."

Waldeyer: "Internally, Reissner's membrane and the crista spiralis join at a more or less acute angle."

According to Krause a transverse section of the ductus cochlearis is more or less triangular.

From the above extracts we see that the later observers do not mention the relaxation of the membrane as first described by Hensen, although it is apparently not so

rarely found in specimens of the human cochlea. Winiwarter alone seems to have made a few such observations. The peculiar, arched shape of Reissner's membrane, described by Löwenberg, may have been caused by his method of preparation, which consisted in putting the cochlea into a solution of gum arabic, which was allowed to coagulate or set. We may assume this to be the cause if we do not wish to acknowledge that the form and consistency of the membrane in the embryonal condition differs from the later stage of development, as would appear to be the case from Boettcher's plates.

From what has been said above, we can easily see that the angle formed by Reissner's membrane in the pathological or histological specimen, is in no definite relation to the curved shape it probably has in life.

BOROGLYCERIDE

IN THE TREATMENT OF PURULENT DISEASES OF THE EAR.

By RICHARD C. BRANDEIS, M.D., NEW YORK.

IN the treatment of purulent diseases of the external and middle ear, whether acute or chronic, the leading indications are, the thorough removal of the secretions which may have accumulated, and the restoration of the affected surfaces to a healthy condition. As suggested by Bezold¹ these desiderata will be most certainly arrived at by the application of the general principles of antiseptics in the treatment of diseases of the ear.

In the article referred to, Bezold strongly advocated the use of boracic acid, which, as he found, answered the purpose of antiseptics more satisfactorily than either carbolic acid, salicylic acid, or thymol. As is generally known, this remedy is to be applied to the diseased parts in the form of a saturated solution or, still better, the meatus and—in case there be a defect in the membrane—the tympanic cavity are to be filled with the finely triturated powder in substance.

In his *Ephemeris*² Squibb says of boracic acid: "It is a very potent antiseptic, probably equal to salicylic acid, * * * and its advantages over carbolic acid, for some purposes, are chiefly that it is odorless and more easily managed." On the other hand, Professor Barff³ says: "I have lately seen it asserted that boracic acid *alone* has not the power of preventing decomposition, but only

¹ Zur antiseptischen Behandlung der Mittelohreiterungen: *Arch. f. Ohrenh.*, Band xv., Heft 1.

² May, 1883, No. 9, page 302.

³ *Journal of the Society of Arts*, London, 1882.

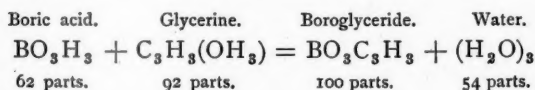
in combination with other substances, and my experience entirely confirms this statement."

In spite of these conflicting views, and influenced by Bezold's urgent advocacy, I proceeded to give boracic acid an extended trial in the treatment of purulent diseases of the ear, limiting my cases to those met with in private practice, in order to be able to watch the results more carefully. I was the more willing to do this, as I had become convinced that the use of the common astringent, solutions of alum, silver, zinc, and potassium permanganate, was not always satisfactory nor unattended with serious evils.

I have, however, found in many cases, that the most careful syringing, and the thorough removal of the morbid secretions, followed by the instillation of the four-per-cent. solution of boracic acid, did not suffice to mask the offensive odors arising from the ear. Discarding the solution, I began to pack the meatus with the finely powdered acid. This did, it is true, lessen the odor, and also diminished the quantity of pus discharged; but I am inclined to believe that the latter was due, not so much to the improved condition of the organ, as to the greater difficulty which the secreted fluid found in making its exit through the thick and dense layer of the powdered acid. In some cases the retardation of the flow of pus was as great as in the use of alum, tannin, and other astringent powders. I observed an occasional tendency of the powder "to cake," which rendered its thorough removal difficult, owing to its firm adherence to the walls and depressions of the cavity. This was the more apt to occur, when some of the powder had passed through the perforation of the membrane into the cavity of the tympanum. In these cases the quantity of water required to dissolve and thoroughly remove the mass was so great, that the secreting surfaces became sufficiently macerated to stimulate the discharges to a degree which rendered all that had been previously achieved, useless. In consequence of this, I became more careful in my use of the powder, and, like many aurists, have almost entirely discarded the syringe,

which is now only used when the secretions have become so dessicated that they must be softened before they can be removed. In the place of the syringe I make use of absorbent cotton, which is attached to small, flexible probes. By this means I am able to absorb all the fluids contained in the meatus and, if the membrana tympani is perforated, I clear the tympanum by means of the air douche or the Eustachian catheter before applying the absorbent cotton. After this is done, a small quantity of finely powdered iodoform and oxide of zinc, in equal parts, is carefully blown into the meatus, so as to form a thin coating over the entire affected surface. This remedy has proved quite satisfactory in my hands, inasmuch as it was readily absorbed and appeared to diminish the quantity and improve the quality of the purulent secretion. Owing, however, to the disgusting and penetrating odor of the iodoform, which neither the attar of roses nor the extract of the vanilla bean is able to disguise, I have time and again had patients so rebel against its continued use that I have been compelled, reluctantly, to refrain from its further application.

In March, 1882, Professor Barff¹ read a paper before the London Society of Arts on "A new antiseptic compound, and its application to the preservation of food," etc. In this address the author showed that boracic acid and glycerine, when heated, combined to form a new substance, *i. e.*, boracic glycerine or boroglyceride. According to Barff the proportion is that of their atomic weights,—thus:



The sixty-two parts of boric acid and the ninety-two parts of glycerine are gently heated over a water bath, the boric acid having been gradually added to the glycerine, until the fifty-four parts of water have been driven off, leaving the one hundred parts of boroglyceride. This, on cooling, is an amber-colored, vitreous mass, which is very

¹ *Loc. citat.*

friable and easily broken. It is readily soluble in glycerine, but less so in cold or hot water (about ten per cent.).

Boroglyceride has an acid, pungent taste, and has an astringent effect when applied to mucous membranes.

Shortly after the publication of Professor Barff's paper, Mr. Balmanno Squire¹ suggested that the new compound be given a trial in antiseptic surgery. This led me to prepare a quantity of the boroglyceride, which I have since then used freely.

I am in the habit of using the boroglyceride in solutions, ranging in strength from ten to fifty and more per cent., generally beginning with the more concentrated solutions, and diminishing their strength as the mucous membrane assumes a healthier condition, and as the discharges diminish. My method of application is thoroughly to clean the diseased surfaces by first driving as much as possible of the secretions out of the tympanic cavity with the air douche or Eustachian catheter; then, by absorbing the fluids with pledgets of borated cotton until all that can be seen is removed. Bending the head of the patient to the unaffected side, or, if both ears be diseased, to the side opposite to the one under treatment, I instil a few drops of the boroglyceride into the meatus, filling it about half. In case there be a perforation of the membrana tympani, I introduce, according to the plan of Politzer, a catheter into the mouth of the Eustachian tube and inflate it thoroughly, so that the air may pass through the column of fluid contained in the meatus. By this means the boroglyceride, be it ever so viscid, is able to pass through the perforation into the tympanic cavity, thereby coming in contact with and exerting its beneficial influence upon the entire secreting surface. I generally make these applications two or three times a week, varying with the intensity and urgency of the case, and at the same time the patient is provided with a quantity of the medicament, and instructed to cleanse the ear as thoroughly as possible morning and evening; then to instil a few drops into the meatus, and plug the ear with cot-

¹ *British Med. Journ.*, April 29, 1882, p. 644.

ton soaked in vaseline, to prevent as much as possible the escape of the boroglyceride.

This remedy has enabled me to discharge patients as cured in from three to four weeks, who, I am sure, under the old methods, would have been under treatment for as many months.

After a few applications have been made, a decided improvement in the condition of the mucous membrane is observable. The congestion is less, the thickening diminished, and the appearance similar to that found in the mucous membrane of the conjunctiva after the application of nitrate of silver. The fetor arising from the retained pus begins to disappear almost immediately, and this in itself is sufficient to recommend the use of the boroglyceride. By repeated applications the quantity of the secretion diminishes steadily, and soon ceases altogether.

When polypoid excrescences or exuberant granulation-tissue are formed in the lower part of the meatus, or in the cavity of the tympanum, I have been in the habit of using a fifty-per-cent. solution of boroglyceride with an equal quantity of eighty-five-per-cent. alcohol. To this mixture the hyperplasia quickly yields; but I am inclined to attribute the beneficial effect more to the hygroscopic action of the rectified spirit and glycerine than to the therapeutic effect of the boric acid.

In three cases of perforation of the membrana tympani after chronic otorrhœa I have employed boroglyceride as an artificial drum-head. These were all cases in which the use of Yearsley's cotton pellet, recently so highly recommended by C. H. Burnett and H. Knapp, could not be persevered in, owing to the irritation and renewed discharge which its continued use gave rise to.

Here I employed a seventy-five-per-cent. solution of boroglyceride (*i. e.*, seventy-five parts of boroglyceride and twenty-five parts of glycerine), a few drops of which were instilled into the meatus and, owing to its viscosity, became adherent to the remaining membrane. In order to keep this in position, the mass of fluid was coated with a thin layer of collodion. Thus I succeeded in improving the hearing of

each patient considerably. The good effect of this artificial drum-head continued during periods varying from three to eight or ten days, when the same procedure had to be repeated.

In acute affections the application of boroglyceride is attended with some pain, but I have been able to control this by adding either the tincture of aconite or a one-half-per-cent. solution of atropia.

The following cases may serve to illustrate the foregoing remarks.

CASE 1.—Edward Sch., aged thirty-one years, while bathing in the Atlantic, at Long Branch, during the summer of 1881, was struck, on the left side of the head, by a heavy breaker. The blow was so violent, that he lost his foothold and disappeared under the waves. As soon as possible he retired to his bathing-house, and found that he was quite deaf in the left ear. As the hearing did not return and some pain was felt, he, a few days after the accident, consulted his physician, who ordered leeches to be applied to the mastoid process, and sedative drops to be instilled into the meatus. These measures appeared to relieve the pain, but did not improve the hearing. As Mr. S. was led to believe that the lapse of time would bring about a restoration of the affected organ, he sought no further advice at the time.

In June, 1882, ten months after the accident, Mr. S. consulted me for the relief of deafness, dizziness, and unsteadiness of gait. He complained most, however, of an exceedingly disagreeable sensation, as of a current of cold air passing through and out of his ear at every expiration. This annoyed him to such a degree as to seriously disturb his mental equipoise.

There had never been any discharge from the ear, excepting for a few days after the injury was received.

On examination, a somewhat opaque and slightly retracted drum-head was found, which showed a large semilunar rupture, extending from the superior anterior quadrant, downward and backward to the inferior posterior quadrant, and to the periphery of the membrane. The edges of the rupture were well retracted and somewhat thickened, showing it to have been of long standing. The handle of the malleus was drawn upward and back-

ward, and the cone of light had disappeared. On testing the hearing, it was found: $hL = \frac{2}{48}$, $VL = \frac{0}{60}$. In the right ear hearing was normal. The pharynx was studded with enlarged follicles, which secreted a large quantity of tenacious mucus.

Although I was not inclined to give a favorable prognosis, Mr. S. begged me to institute a line of treatment which might afford some relief for the dizziness and the stumbling gait, and to free him from the troublesome effects of the current of air which passed through his ear. I carefully introduced a small pellet of borated cotton into the meatus, and gently pushed it down to the drum-head, so as to cover the entire perforation. I also ordered large doses of quinine, in the hope that they might relieve the vertigo, and requested the patient to return in a few days. I saw him again after the lapse of forty-eight hours, because of ear-ache, and a purulent discharge, which had set in during the night after the first visit. I removed the cotton pellet, and found the membrana tympani much inflamed and the lips of the perforation bathed in pus. The ear was thoroughly cleansed by the dry method, and a few drops of a fifty-per-cent. solution of boroglyceride were instilled. This was to be repeated every four hours, and the patient was ordered to return in two or three days. He did not come again for more than a week, when it was found that the discharge had entirely ceased, and the size of the perforation was considerably lessened. I learned from the patient, that for several hours after the use of the drops the rush of air was hardly noticeable, but after this again became annoying. Half a drachm of quinine had been taken daily for nearly two weeks, and served to improve the patient's general condition, and had also relieved the dizziness and the impaired co-ordination.

I now applied five or six drops of a seventy-five-per-cent. solution of boroglyceride by means of a small pipette. These were introduced, through the perforation, into the cavity of the tympanum. The entire drum-head was smeared over with a thin coating of collodion and the meatus loosely packed with cotton. This application afforded marked relief, checking the passage of air entirely for four or five days, when the layer of collodion became detached and the old trouble reappeared. I repeated the above applications, at intervals of a week, for several months, and for some time observed a gradual diminution in the size of the perforation. But as this did not seem to continue I did not feel justified in pro-

longing the treatment, and in Sept., 1882, I gave the patient a quantity of the boroglyceride with instructions to apply it every night. This he did for six months, and in March, 1883, he again visited me. At that time I learned that he had not suffered at all from dizziness and unsteadiness of gait since I last saw him; the use of the boroglyceride had succeeded in lessening the intensity of the current of air, but had to be applied without intermission. On inspection, the rupture was found to be only about one third its original size.

The patient has since removed from the city, and on inquiring, I learned a few weeks ago, by letter: "I have so far recovered that I do not think I need subject myself to any further treatment."

CASE 2.—Willie T., aged eighteen years, was first examined Sept. 17, 1883. He stated, that five years before, he had suffered from an attack of malignant scarlet-fever, in the course of which his ears and throat were seriously affected. Since then hearing has been greatly impaired, and there has been an almost uninterrupted flow of pus from both ears. During the intermissions the deafness always became more marked, and earache invariably supervened.

On examination, I found the meatus on both sides almost filled with offensive pus. $\frac{1}{2}$ R = $\frac{1}{4}$; $\frac{1}{2}$ L = $\frac{1}{4}$; V R = $\frac{1}{8}$; V L = $\frac{1}{8}$. After removing the secretions, hearing was noticeably better, viz: $\frac{1}{2}$ R = $\frac{1}{8}$; $\frac{1}{2}$ L = $\frac{1}{4}$; V R = $\frac{1}{8}$; V L = $\frac{1}{8}$. Inspection now showed large perforations of both *Mt*, with polypoid excrescences cropping out through the perforated left drum-head. These granulations were found to arise in the tympanic cavity, and were removed by means of Blake's snare. When the hemorrhage had ceased both meatuses were thoroughly cleansed and lightly packed with a powder composed of equal parts of finely triturated boracic acid, iodoform, and oxide of zinc. The patient was told to syringe both ears, night and morning, and then to insufflate the powder just mentioned. He was to return in four or five days for further treatment.

On the third day Mr. T. again called, saying, that since the first insufflation of the powder the discharge had entirely ceased, but the pain in the ears and throat was so intense, that he was unable to attend to his school duties or get any sleep. On examination, I found some of the powder firmly impacted in the lower portion of the auditory canals, although repeated injections had been

made in order to remove it. The mass was so thoroughly caked that I had to remove it by means of forceps, a prolonged current of warm water not sufficing to break it down. I had so often met with this complication, as noted above, that I determined to omit the further use of the syringe and the powders in this case. The ears were thoroughly cleansed by means of absorbent cotton, and a few drops of the fifty-per-cent. solution of the boroglyceride instilled as deeply as they would go. This was well borne, the pain disappearing in the course of a few hours. This remedy was applied, by the patient's friends, morning and evening. A week later, I found the condition of the mucous membrane in both ears much improved, the discharge having steadily diminished. In November, 1883, both perforations had become so much smaller that I discharged the patient from further treatment, with the instruction to return as soon as a relapse set in. Since that time I have not again seen Mr. T., and I may, therefore, conclude that he is practically cured.

A CASE OF PRIMARY PERIOSTITIS OF THE MASTOID.

By Dr. CORNELIUS WILLIAMS, OF ST. PAUL, MINN.,
FORMERLY ASSISTANT SURGEON AT THE N. Y. OPHTHALMIC AND AURAL INSTITUTE, ETC.

On May 11, 1883, Charlotte Mead, aged eleven years, was sent to me by Dr. James Davenport. She had had an occasional earache for several years, but there had been no discharge from the ear at any time, nor had there been any serious impairment of hearing. The patient states, that it has been her habit when suffering from earache to stuff the ear with cotton, and that often, when coughing violently, the cotton pellet would be forced out and for some distance upon the floor, indicating an unusual patency of the Eust. tube on that side. The girl is tall for her age, of somewhat scrofulous appearance, blonde, and, in general, has pretty good health. The right auricle is seen to stand out from the head at almost a right angle, and behind, and chiefly over the superior portion of the mastoid region there is a well-marked swelling with redness and œdema, which pits on pressure, and the elevation is about equal in size to a pullet's egg. The auricle is also reddened and swollen. The external auditory canal is normal. The membrana tympani is entire without cicatrix, and is slightly reddened. Hd. 10 inches for the watch; it is less on the left side, and there is evidently chronic aural catarrh. The patient states that there has been great pain for three nights, so much as to deprive her of sleep. Pressure over the swollen part is not extremely painful now, and there is also some tenderness on pressure upon the temple, just in front of the ear. There is no swelling, pain, or stiffness in the sternocleido-mastoid, or the nape of the neck; the pain all tends anteriorly.

An ice-bag was ordered to be constantly applied over the swelling. May 12th, the pain is much less, and the swelling has diminished markedly. She says she has not slept so well for a week as last night. The redness of the *Mt* is almost entirely gone. She does not hear so well as yesterday. On May 16th, I found that the swelling had entirely disappeared, the *Mt* is no longer red, and she hears the watch at 20", which is as she heard before the onset of the disease.

This would seem to have been a case of acute primary inflammation of the periosteum of the mastoid, differing from most of the cases which have been reported, in that the periostitis *was* primary and unattended by other apparent complications.

The efficacy of the ice treatment, as recommended by Politzer, which has served me well in other forms of mastoid disease, is here very well shown.

A CASE OF CHRONIC PURULENT INFLAMMATION OF THE MIDDLE EAR, COMPLICATED BY FACIAL PARALYSIS, NAUSEA, VOMITING, UNSTEADINESS IN THE GAIT, AND MARKED DEAFNESS.

By GORHAM BACON, M.D.,

SURGEON NEW YORK EYE AND EAR INFIRMARY.

Frank Cottman, farmer, æt. twenty-four, consulted me Oct. 16, 1883, on account of a discharge from both ears; had scarlet-fever and measles fifteen years ago but no ear-trouble at that time; is subject to frequent colds in the head and has "catarrh." About five years ago he first commenced to have earaches, which were repeated after every exposure to cold, and each time pain was attended with discharge. About three years ago, a doctor in Reading, Penn., he says, removed "tumors" from both ears, and told him, eighteen months ago, that the ears were entirely cured. For the past year he has gradually been growing deaf, and for the same time the ears have been discharging slightly. Three weeks ago the discharge began to be very profuse. About a week before I saw him the discharge from right ear became very offensive and increased in quantity. At the same time patient had an attack of nausea, vomiting, and vertigo which continued for three days, and which was brought on by a cold. Every time that he attempted to walk all objects seemed to turn round in a horizontal plane from left to right; he had tinnitus for some time in both ears, but it was not increased during this attack.

H. D. for the watch $\frac{0}{0}$ for both ears. Tuning-fork placed on the forehead, heard about the same in each ear. Patient only hears when I stand close to him and shout. He has hypertrophic nasal catarrh with septum nasi deviating to left side; catheter on

this side introduced with difficulty. Left auditory canal narrowed and filled with granulations; right auditory canal also contains granulations, and *Mt* seemed to be perforated and partially adherent to inner wall of tympanum. By Politzer's inflation air passes through both ears; more freely through right one. Patient given calcium sulphide. Granulations touched with chromic acid (sat. sol.); canals dried with absorbent cotton and pulv. acid. boracic. insufflated.

Nov. 2d. Same treatment has been continued ever since; discharge less; hears loud voice now. He has been unsteady in his gait several times when turning round suddenly. H. D., R, $\frac{1}{8}$, $\frac{1}{16}$, L, $\frac{1}{8}$, $\frac{1}{16}$. Plug of absorbent cotton inserted to-day in left meatus, to dilate canal.

Nov. 8th. Feels very much better; hearing for the voice improved; has not been subject to vertigo or unsteadiness in gait since last visit. Eustachian catheter has been used during the past week, as air has not passed readily through tubes by Politizer inflation.

Nov. 9th. Hearing has been much improved until last night about midnight when he had severe pain in the left ear; also at angle of jaw and shooting up over side of face and temporal region. This morning he noticed that his face was drawn to one side; cannot whistle or close left eye; food accumulates between cheek and gums, and saliva dribbles down on affected side; soft palate and tongue deflected to right. Facial paralysis well marked on left side; ptosis slight. H. D., R, $\frac{1}{8}$, $\frac{1}{16}$, L, $\frac{1}{8}$, $\frac{1}{16}$. Tuning-fork on vertex heard better in right ear; discharge profuse and very disagreeable from left ear. Inner end of left audit. canal swollen and inflamed; catheter used. Acid. boracic. et hydrastis insufflated. For several days he has been using alcohol instilled into right ear.

Nov. 10th. H. D., R, $\frac{1}{8}$, $\frac{1}{16}$, L, $\frac{1}{8}$, $\frac{1}{16}$; has had some pain at angle of jaw; small polypus removed from left ear. Ophthalmoscopic examination made but nothing abnormal found.

Nov. 13th. Polypus removed from right ear, protruding through perforation close to short process of malleus; granulation removed from left ear. While syringing left ear to-day, incus, almost entire, and carious on inner surface, came away; discharge very offensive; caries of mastoid antrum undoubtedly exists; no pain over mastoid process.

Nov. 14th. A great deal of cheesy matter syringed out from

left ear ; granulation from upper portion of bony canal (left) removed with Sexton's snare. Paralysis about the same ; catheter used ; iodoform insufflated.

Nov. 16th. Patient feels much better ; facial paralysis less marked, deglutition not as affected as it was ; discharge from left ear less offensive ; upper portion of left bony canal carious ; iodoform used as before, and plug of cotton inserted to dilate canal as before.

Nov. 22d. Iodoform has been used every day, also Eustachian catheter. No dizziness for some time. Electricity begun to-day ; muscles respond but slightly, if at all. Taste slightly affected on left side of tongue. Strychnia, $\frac{1}{64}$, gr. given three times daily.

Nov. 28th. Granulation removed from upper portion of left bony canal, and small, remaining part of incus came away.

Dec. 5th. H. D., L., $h. \frac{3}{16}$, R., $h. \frac{1}{16}$. Acoumeter, L, 1', R, 12'. Tuning-fork on vertex heard a little louder in right ear. Patient hears the voice now when slightly raised ; is much improved in general health ; appetite good.

Dec. 10th. Left auditory canal is now well dilated. *Mt* entirely destroyed, discharge slight and not offensive ; upper portion of bony canal carious. Right *Mt* partially destroyed posteriorly, and adherent to inner wall of tympanum. Several small granulations on inner wall of tympanum. For several days pulv. acid. boracic. et calendulæ has been used with benefit. Some discharge from this ear. In testing the hearing with the tuning-fork, bone-conduction is better for both ears than aërial conduction. There is a well-marked difference for the left ear, while it is but slight for the right. Patient is able to whistle now, and there is some improvement in the paralysis.

This case seems to me to be of considerable interest for the following reasons : A week before I saw the patient, the symptoms were of a serious nature, indicating probable implication of the semicircular canals, as shown by the attack of vomiting, vertigo, and unsteadiness in the gait. After both auditory canals were dilated, the polypi and granulations removed, so that the purulent discharge had a free exit, there was a marked improvement in the patient's general health, appetite, etc., a decided change for the better in the patient's hearing, and a disappearance of the vertigo and unsteadiness in gait. The occurrence of facial

paralysis is also very interesting, as the nerve is rarely affected in cases of otitis med. pur. chron. Roosa, in his "Treatise on the Ear," in speaking of the occurrence of facial paralysis in the course of chronic suppuration of the middle ear, says: "In the greater number of cases in which it occurs, it is permanent, from the fact that the nerve tissue is destroyed by the ulcerative process; but I have seen cases of temporary paralysis of the seventh, which were probably due to pressure upon the nerve trunk; for, where the supuration of the ear was checked, the functions of the nerve were restored and the face resumed its normal appearance." Politzer believes that slight facial paralysis more often occurs during the course of middle-ear disease than is generally supposed, but that it escapes observation. Wilde and Von Troeltsch have shown that facial paralysis is developed at times when middle-ear disease occurs without perforation. Necrosis of the Fallopian canal may occur, however, and the nerve be bathed in pus, and there is no paralysis until the nerve itself is inflamed. Different branches of the facial nerve may be more affected than others; sometimes the paralysis is more developed in the muscles about the eye, sometimes those about the nose or mouth. When the soft palate is paralyzed, it is probable that the inflammation attacks the facial nerve at the gangliar intumescencia, or between it and the brain, as the levator palati and azygos uvulæ muscles are supplied by the Vidian nerve, which joins the facial at this ganglion, through the large petrosal nerve. This assumption of facts is by no means certain. The prognosis as to ultimate recovery from the facial paralysis in the case which I have recorded, is unfavorable, as there exists considerable necrosis of the upper wall of bony canal, and probably of the mastoid antrum.

TWO FATAL CASES OF CARIES OF THE TEMPORAL BONE; OPENINGS MADE THROUGH ROOF OF TYMPANUM; AUTOPSIES.

By T. Y. SUTPHEN, M.D., NEWARK, N. J.

CASE I.—*Sept. 25, '83.* Was called to see Alfred B., æt. forty-four, wire-weaver. The day previous he travelled a long distance in the cars, and walked home from the depot, several squares. For twelve years he had suffered from otorrhœa. Pain began a few days before. No further history could be obtained.

I found him persistently lying upon the right side, breathing stertorously, and perspiring; face flushed, and pupils contracted. When aroused, and asked regarding pain, could not speak,—showing complete aphasia,—but, muttering, passed his hand across the forehead and left side of head. Right ear contained a little cheesy pus, which, when removed, exposed a large perforation of the membrane. Left external canal partly filled with thick, offensive matter, and partly occluded by the swollen posterior and upper walls, which, when touched, caused the patient to shrink. No tenderness nor swelling over either mastoid. Ophthalmoscopic examination unsatisfactory, but sufficient to show swollen retinal veins. Temperature not taken; pulse 80. Ordered fomentations, and sent patient to St. Michael's Hospital.

Sept. 26th. Symptoms much the same as day before, but coma increased, seventh nerve, left side, paralyzed, and pupils still contracted. Ophthalmoscope showed choked disc in both eyes. Right ear dry; left filled with secretion. Made a long incision through the swollen tissue in left external canal, giving exit to a little thick pus, and revealing extensive caries of the posterior and upper walls of this passage and the middle ear—the probe passing well back into the mastoid. Immediately following this operation, complete paralysis of the right arm and leg was

noticed. Members of the hospital staff present, concurred in the opinion, that there was an accumulation of fluid in the immediate vicinity of the diseased bone, and that to liberate this was the only means of prolonging the patient's life. A thorough search was made for sequestra or sinuses, but none found.

Concluding that no benefit would arise from further opening the mastoid, it was thought best to perforate the roof of the carious cavity, which was done by drilling with an ordinary trocar, depressing the handle as much as possible, and directing the instrument nearly upward. A probe was then passed, with care, well into the cranial cavity, and withdrawn, but no fluid escaped. This was repeated with a like result. Supposing, then, that the abscess, if it did exist, was beyond reach, the case was considered hopeless, and further efforts at relief abandoned.

Sept. 27th. Twenty-four hours after the operation patient in profound coma and dying; pupils widely dilated, and left external canal filled with a brown, offensive, watery discharge entirely different from that previously found. Death two hours later.

The AUTOPSY showed an immense abscess, occupying nearly the whole of the anterior and middle lobes of the left hemisphere of the brain, containing a dirty-brown, extremely fetid collection of pus, resembling that found in the external canal; the walls were formed by a thin layer of greenish, softened brain-substance. The opening made by the operation entered the cranial cavity on the superior surface of the petrous bone, just in front of the superior petrosal sinus, and at a point corresponding to the eminence for the superior semicircular canal. In the depression just external to this, a circle of dead bone, one fourth inch in diameter, appeared. To this the dura mater was attached and perforated by a small circular ulcer. There was some localized meningitis. The parts behind the tentorium were natural, and the large ganglia at the base escaped being involved.

The instrument used at the time of operating, had pierced the dura mater and entered the abscess cavity, but the flow of pus was probably prevented by either the soft brain-substance or the dura mater itself acting as a valve, which might have been obviated, had the opening been en-

larged. The pus must have exercised considerable pressure, as a jet was thrown out several feet when the meninges were punctured. Further examination of the temporal bone was prevented by the haste of the family in removing the body.

The case seems to be instructive, in that it shows that an abscess in this locality can be quite readily and safely reached, when chances of relief by trephining the mastoid are wanting, and if done early enough, might prolong, if not save, life, by removing the pressure within the cranial cavity. In this case a favorable result could not have been obtained, even with a free opening, the changes in the brain-substance being great, but, no doubt, an early operation might have been beneficial.

CASE 2.—Rudolph Z., æt. twenty-one, admitted to St. Michael's Hospital Nov. 16, 1883, stated that, ten years ago, while ill with measles, his right ear first became affected. An almost continuous discharge had existed since. Two weeks previous to admission the amount of secretion greatly increased, and he began to have severe pain in that ear, spreading over the right side of his head and forehead, which became more intense each day.

Nov. 17th. He was unable to leave his bed; his countenance indicated suffering; the skin was bathed in perspiration; the right external auditory canal was partly filled with muco-pus, and partly occluded by swelling of its walls, which prevented a view of the middle ear. There was no tenderness, œdema, nor swelling about the mastoid, and no sensitive spot was found by percussing that side of the cranium. Inflation by Politzer's method ineffectual and painful. There was complete paralysis of the right abducens muscle, and the sight was impaired in each eye. The ophthalmoscope disclosed swelling of the disc and distention of retinal veins in both eyes. The patient had a short, severe chill in the morning, followed by a rise in temperature and profuse sweating. T., A.M., $104\frac{1}{2}^{\circ}$; P.M., $100\frac{3}{4}^{\circ}$; pulse, 100. Warm water and steam was ordered for the ear, and bromides internally.

Nov. 18th. The discharge was less, as was also the swelling in the external canal; the cavity of the tympanum, which could be seen, presenting a granulating surface. Sight was greatly impaired, and the patient had two chills, morning and evening. T., A.M., $100\frac{1}{2}^{\circ}$; P.M., 101° ; pulse, 87.

Nov. 19th. Again two chills and profuse sweating, paroxysmal pain, total loss of vision, and inclination to lie upon the right side. Peculiar muscular twitchings were noticed about the limbs. T., A.M., $100\frac{1}{2}^{\circ}$; P.M., $102\frac{3}{4}^{\circ}$; pulse, 100. Quinine administered.

Nov. 20th. One chill. T., A.M., 102° ; P.M., $102\frac{1}{2}^{\circ}$; pulse, 100.

Nov. 21st. No chill, less pain, slept without medicine, and seemed decidedly brighter. Scarcely any discharge from the ear, and the patient had slight perception of light. T., A.M., 104° ; P.M., 102° ; pulse, 100.

Nov. 22d. Condition about the same, but the sight rapidly improving. T., A.M., 103° ; P.M., $102\frac{1}{2}^{\circ}$; midnight, 104° ; pulse nearly 110.

Nov. 23d. He was drowsy, but started frequently with severe pain; the discharge from the ear had increased; the ophthalmoscopic appearance was unchanged, but sight was sufficient to count fingers at twelve feet with each eye. There was a general typhoid appearance about the case; his lips and tongue were dry and parched, sordes on the teeth, and tenderness in the right iliac fossa, but no spots characteristic of typhoid fever, and the skin instead of being dry was moist. T., A.M., 105° ; P.M., $102\frac{3}{4}^{\circ}$; midnight, 104° ; pulse, 100.

Nov. 24th. Mild delirium. T., A.M., 102° ; P.M., 103° ; pulse, about 120.

Nov. 25th. Patient showed exhaustion, and was semi-comatose, but could be aroused, and answered rationally; the pupils were normal, and there was no further paralysis. T., A.M., 104° ; P.M., 103° ; pulse, 130.

Nov. 26th. Coma. T., 104° ; pulse, 140. An incision was made through the swollen tissue in the external canal, upward. A bent probe inserted through this cut passed over bare bone, and at two thirds the depth of the canal slipped into a carious passage, and with very slight resistance entered the cranial cavity. Although the symptoms did not point to the presence of imprisoned pus, it was thought better to enlarge this bony sinus, which was done with a trocar, and the probe re-inserted—but no pus escaped. Patient remained comatose until midnight, when he died.

At the AUTOPSY the right lateral and superior longitudinal sinuses were found occupied by a large, and partially organized clot, breaking down in various places; the walls of

the sulcus, for the lateral sinus, were discolored, showing carious changes; circumscribed meningitis existed contiguous to the temporal bone, and there was incipient softening on the surface of the middle lobe. The opening into the cranial cavity was found in the depression just external to the eminence for the superior semicircular canal, surrounded by carious bone which easily crumbled under pressure, the probe having passed into the substance of the brain. There was very slight hemorrhage in the track of the instrument. No accumulation of pus was found. The temporal bone, which was removed, was extensively carious, involving the walls of the middle ear and the mastoid portion. No examination was made of the other parts of the body.

In *reviewing these two cases*, both resulting from caries of the temporal bone, subsequent to chronic middle-ear disease, the contrast in the chief symptoms is striking.

With the cerebral abscess we had lessening of the discharge, marked changes in the size of the pupil, choked disc, extensive paralysis, early coma, and a rapidly fatal result.

With the thrombosis, increased secretion, normal pupil, swollen disc, slight paralysis, and tardy termination. In neither was there nausea or vomiting, and there was an entire absence of swelling or œdema about the mastoid. The other symptoms in case 2 were what we might expect in blood-poisoning—but interesting features were the changes in the patient's vision, and cessation of the chills on administration of quinine.

I should state that the heart-beats, as recorded, were approximate, and generally taken in the morning.

CLINICAL NOTES OF CASES OF DISEASE OF THE NERVOUS APPARATUS OF THE EAR.

By CHARLES J. KIPP.

AS the following cases present some features not often seen in connection with Ménière's train of symptoms, I place them on record.

CASE I.—*Ménière's train of symptoms preceded by a febrile paroxysm and followed by neuralgia and an erysipelatoid inflammation of the face. Partial recovery of hearing.*

H. H., a small, spare man, forty-eight years of age, consulted me for the first time on the 28th of November, 1882. The previous history of the case is as follows: *He has been totally deaf in his right ear since infancy.* This ear has never given him any pain, and it has at no time discharged matter. *The hearing of the left ear was, until the present sickness, so acute that his associates were not aware that he was deaf in one ear.* He has never had pain in this ear. He has at no time been sick enough to require the services of a physician, and there is no suspicion that he has had syphilis.

On the 12th of October, 1882, in the evening, he had a severe chill, which was followed by fever and sweating. On the following days he felt very tired and suffered much from headache, especially in the left frontal region. These symptoms had, however, almost passed away, without treatment, by October 19th, a week after the chill. On the evening of that day while on his way home from his work he felt very dizzy, and his left ear felt as if it was stuffed full of cotton-wool. At the same time he felt great roaring in this ear. Later in the evening the roaring increased in loudness and at bedtime he was so deaf that he could not hear his wife's voice. Being very tired he slept some, and on awaking

next morning he found to his great joy that his hearing was in a great measure restored. The roaring had ceased, but he heard now a loud hissing noise. While in bed he was free from dizziness, but on rising it returned. The tinnitus and vertigo continued for some days and then gradually passed away. His hearing had, in the meanwhile, become almost as acute as it was before this attack.

During the next two weeks he felt entirely well, but on the morning of the 12th of November, twenty-four days after the first attack of deafness, he had another severe attack of vertigo and roaring in the ear, which was speedily followed by complete deafness. The deafness continued for about twenty-four hours, and then gradually passed away. The tinnitus and vertigo continued longer than in the first attack, and he therefore consulted his family physician, with regard to these symptoms, who gave him a cathartic, which relieved him somewhat but not entirely.

A marked increase in the vertigo and tinnitus was noticed on the 24th of November, for which his physician now gave him moderate doses of quinine. This remedy failed however, to give him the slightest relief.

In the evening of the 27th of November he had again a sensation of great fulness in the left ear, and an increase in the tinnitus, and an hour afterward he was again totally deaf. I learned subsequently from his physician that he had prescribed the quinine in five-grain doses, to be taken three times daily.

On the morning following, the 28th November, I saw the patient for the first time. On examination I found that he was unable to hear my voice even through an ear-trumpet, and I therefore had to communicate to him in writing. Tuning-forks held in front of either ear were not heard, nor were they heard when placed in contact with the skull, although the vibration was felt. The patient, who is a very intelligent man, assured me that he was in no doubt about this. The tick of the watch (normal distance, 60 inches) was not heard when pressed against the auricle or the mastoid on either side. In both ears the external canal and the drum membrane were entirely normal. The Eustachian tubes were permeable. Inflation of middle ear caused slight bulging of the drum membrane, but no hyperæmia. Although confident that there was no fluid exudation in cavity of the drum, I thought it best to assure myself of the fact, and therefore made an incision in the posterior half of the drum membrane of the left ear. No

fluid escaped through the opening and on inflation nothing but air came through the wound. The patient was very dizzy and complained of great noise in the left ear and pain in the head.

There was no disease of the nose or throat. Examination of the eyes with the ophthalmoscope showed the optic disc and the retina to be quite healthy in both eyes. The urine contained neither albumen nor sugar, but was loaded with phosphates. There was no disease of the heart.

As quinine had already been given without producing relief, I concluded to try local depletion and applied six leeches to the left mastoid process. The patient was put to bed, and sinapisms were applied to his legs and feet. During the next six days the vertigo was almost constant, even while the patient was on his back in bed. The roaring diminished in intensity, but the deafness continued as before. The incision in the drum-head healed in two days. After that the middle ear was inflated daily, and quinine was given in five-grain doses three times daily.

From December 6th to January 3d, the patient was under the care of Dr. Lehlbach, to whom I am indebted for the following notes :

On December 18th, while the symptoms described above continued, the patient was attacked by very severe neuralgic pains, which started in the left forehead, and soon spread over the entire left side of face and neck, and to the teeth and gums of this side. This pain continued unabated for four days, and before it ceased the skin of the left side of the face became swollen and intensely red. This condition lasted for about four days and then gradually passed away. No herpes was observed, and no desquamation followed the attack. On the night of the second day after the commencement of the swelling of the face, the patient had another severe chill, which lasted some time, and was followed by heat and perspiration. While under Dr. L.'s care, he was treated at first with tincture of iodine, fifteen drops, and iodide of potassium $2\frac{1}{2}$ grains, three times daily, to which later were added eight drops of fluid extract of ergot. During the attack of neuralgia he was given quinine and morphine, and after this attack had passed over the tincture of iodine was resumed.

On January 3d I saw the patient again. He was still as deaf as when I last saw him. The vertigo had, however, diminished so much that he was able to work. The tinnitus continued, but

was not very annoying. He had still much pain in head at times. I prescribed iodide of potassium, ten grains, three times daily.

On March 3d he was still somewhat giddy occasionally, especially on raising his head after stooping, and his walk was not yet very steady. The tinnitus had slowly decreased in loudness. He was able to hear loud sounds, and sometimes could understand words shouted in his ear, but for all useful purposes he was as deaf as before. He thought that he heard a large C[♯] tuning-fork when held half an inch from external meatus of left ear, and also when placed on mastoid.

In February, 1884, about fourteen months after his first visit to me, he was able to understand loud words spoken directly into the left ear. When holding his hand behind the auricle and pressing it forward, he heard and understood all I said in a loud voice. He heard my watch when it was pressed against the auricle, but did not hear it from the mastoid. Politzer's acoumeter was heard two inches from ear and also from mastoid. The C[♯] tuning-fork was heard when placed on mastoid, but it was heard more distinctly and much longer when held half an inch from external meatus. No reaction of the auditory nerve could be obtained by a galvanic current of a new battery of ten cells. The patient was in excellent health, and was entirely free from headache.

The facts, that the hearing of the left ear was very acute before the initial chill, and that absolute deafness was very rapidly developed without the slightest objective signs of disease of the middle ear, make it tolerably certain, I think, that this case was one of primary disease of the nervous apparatus of the ear. As regards the nature of the morbid process it may be assumed that it was of an inflammatory character; the chill which preceded the first attack and the erysipelatoid inflammation of the face which was developed later in the disease leave little room for doubt on this point. It seems probable that this inflammation started in the cerebral meninges at the base, thence spread to the labyrinth, and later also to the Gasserian ganglion. The chill and the severe headache were probably caused by the circumscribed basilar meningitis; the first and second attacks of vertigo and deafness

by a sudden increase in the existing hyperæmia in the labyrinth; and the last attack was, perhaps, the result of an extensive serous effusion into this structure. The neuralgia and the inflammation of the skin were probably due to hyperæmia or a slight inflammation of the Gasserian ganglion.

That the medulla oblongata was the seat of the inflammation seems improbable, as only the left organ of hearing was affected in this attack. There was at no time tinnitus in the right ear, and it may, therefore, be assumed that the nervous structures of this ear were not involved.

The view above stated as to the probable seat of the disease is, moreover, strengthened by the fact that the hearing for speech was partially restored while deafness for low tones remains.

Cases of this character must be rare, as the above is the only one that I have seen, so far as I can remember, in which Ménière's train of symptoms was ushered in with a chill, in an adult. Similar cases are not unfrequently met with in young children, but in every one that I have seen the hearing of both ears was totally destroyed. In children I have always looked upon the disease as a very mild form of cerebro-spinal meningitis, though it occurs not unfrequently at periods when no epidemic of this disease is prevailing. Occasionally, metastatic choroiditis of one or both eyes is developed in children in whom the symptoms of this form of meningitis are so mild that the parents do not think it necessary to employ a physician.

How much the treatment had to do with the partial recovery of hearing, it is of course impossible to say. I have seen, however, other cases of this kind in which the long-continued use of the iodide of potassium seemed to be of benefit.

CASE 2.—*Ménière's train of symptoms, followed by neuralgia and erysipelatoid inflammation of the face.*

A gentleman, forty-one years of age, came to me on the last day of October, 1882, for treatment of hardness of hearing. From his wife, who accompanied him, I learned that up to the time of

the attack, to be described further on, he had always been in excellent health, and of a jovial, cheerful disposition. The only additional fact worth noticing, relating to his previous history, ascertained from him afterward, was that about twenty years ago he had a chancre, for which he was treated with mercury; no secondary symptoms followed. He is married, and has several healthy children. Two weeks before he came to me, he felt for the first time a rumbling and roaring in his right ear; none was felt in the left ear. A week later he noticed that he was entirely deaf in the right ear. He has had no nausea or sickness of stomach, but during the last two weeks he has felt very giddy at times. Of late his gait has been so unsteady, that he has ventured out-of-doors only when supported by the arm of a friend. A most noteworthy feature and the most alarming symptom to his friends has been the very great mental depression and excessive nervousness under which he has been laboring during the past week. According to his own statement, as well as that of his friends, there is no cause for this in his family or business relations, and it must therefore be regarded as part of the disease from which he is suffering. He is unable to sleep, although he has no pain anywhere. His hearing was perfectly good in both ears before this attack, and he does not remember ever to have had otorrhoea.

On examination, I found that the *right* ear was totally deaf for speech, watch, and tuning-forks; the latter, when placed on vertex or between the teeth, were heard only in the good ear. With the *left* ear he heard a whisper at about $\frac{3}{4}$ the normal distance, and the watch (60 inches) at 40 inches. Tuning-forks were heard equally well from mastoid as when held before external meatus. An attempt to ascertain the galvanic reaction of the right acoustic nerve had to be given up, as even the weakest current greatly increased the vertigo and the tinnitus.

Examination of the *right* ear revealed a normal external canal; a dull, opaque, and somewhat sunken membrana tympani, the mobility of which was impaired. No hyperæmia of handle of malleus. Eustachian tube easily permeable. Sounds dry and broad.

In the *left* ear the drum-membrane was opaque and depressed, and contained in its posterior half a large, oval, depressed, and flaccid cicatrix. Tube permeable. Inflation caused marked bulging of cicatrix.

Although there was no evidence that the tympanic cavity of right ear contained a fluid exudation, I thought it best to remove all

doubts on this point by incising the posterior half of the drum-membrane.

No fluid escaped through opening, and on inflation only air came out of it.

Ophthalmoscopic examination showed the background of the eyes to be normal.

The urine contained phosphates in great abundance, but neither albumen nor sugar.

I advised rest in bed, and prescribed a combination of iodide and bromide of potassium.

Two days later the condition of the patient remained unchanged. The incision in the drum-membrane had healed. After this date inflation of the middle ear through the catheter was practised every other day, in addition to the other treatment.

On the 6th of November, the vertigo was more marked and more constant than previously, and all loud sounds were very painful to him.

Until the 15th no noteworthy change occurred. Then he complained of great neuralgic pain in the entire right side of the head and neck, which prevented him from sleeping. These parts were sore to the touch, and a few days later the skin of the right half of the face became very red and somewhat swollen. No irritating lotion had been applied to these parts. The redness and swelling subsided in four or five days, but the pain although less severe, continued for more than a month. No vesicles were visible during, and no desquamation followed, this attack.

Since then the tinnitus and the vertigo have troubled him only at times. The deafness of the *right* ear continues. His gait is still at times unsteady. The mental depression and the nervous irritability have in a large measure passed away. He is, however, constantly haunted by a fear of becoming totally deaf, as the good ear has occasionally a feeling of fulness and he imagines that its hearing is not as acute as formerly. Repeated examinations have, however, convinced me that there is no marked deterioration of hearing of this ear. During the last twelve months I have treated him off and on for naso-pharyngeal catarrh. In January, 1884, he was still in the condition last described.

This case is not unlike many others on record in this, that it is impossible to say how much of the deafness was caused by middle-ear disease. My patient was confident that

before the attack of tinnitus he heard as well with the right ear as with the left, if not better, and yet the condition of the drum-membrane would indicate disease of long standing. There can be no doubt, however, that after the attack of roaring in the ear, the hearing was rapidly destroyed; and as there were no signs of acute middle-ear disease it must be assumed that an affection of the nervous apparatus of the ear caused this destruction. For the reasons already given in discussing the first case, a disease of the medulla oblongata can probably also be excluded in this case, and the entire absence of febrile symptoms will doubtless be regarded as proof that a basilar meningitis did not exist. Yet cases are occasionally met with, especially in connection with chronic purulent inflammation of the middle ear, in which the only manifestations of a congestion if not inflammation of the membranes at the base are moderate headache and neuritis optica of one or both eyes, and it is therefore at least not impossible that in this case inflammation of the labyrinth caused hyperæmia of the cerebral membranes at the base and also of the Gasserian ganglion.

The above cases are the only ones that I have seen in which manifestation of irritation of the trifacial nerve occurred in connection with disease of the nervous apparatus of the ear, and so far as I know MOOS is the only author who has described similar cases. See *Virchow's Archiv*, Bd. 68, Heft III., p. 433, also MOOS: *Ueber Meningitis cerebrospinalis Epidemicus*, p. 28.

Case 3.—Sudden, complete, and permanent destruction of hearing of one ear.

Mrs. V., fifty years of age, a slender woman, with very pale complexion, the mother of many healthy children, who had always heard very acutely with both ears, and who had never had tinnitus, felt suddenly, while walking in a strong wind, a tremendous roaring in her left ear, and at same time felt a little confused in mind, but did not lose consciousness. She did not fall, and felt no nausea. Immediately afterward she noticed that she was unable to hear with this ear. The deafness and the tinnitus continued at the time she consulted me, ten days after the attack. On examination I found that she was unable to hear loudly spoken words with

the left ear. Politzer's acoumeter was heard two inches from this ear when the other ear was open, but not at all when this was tightly closed. The watch was not heard when pressed against auricle or held against mastoid. Large tuning-forks of different pitch were not heard when held before external meatus, but when placed on mastoid were heard in the other ear. Placed on vertex they were apparently heard on both sides.

The hearing of the right ear was perfect.

On inspection nothing abnormal could be discovered in the external canal or in the condition of the drum-membrane of either ear. The tubes were permeable, and inflation caused bulging of upper part of drum-membrane in both ears. There was no pharyngeal catarrh, and the patient's general health was good. She had only occasionally a slight feeling of giddiness. Her walk was as steady as ever. I ordered quinine in five-grain doses twice daily, and under this treatment the tinnitus speedily disappeared, but the deafness continued.

Four years later I saw the patient again and found the condition last noted unchanged. There had been no return of the tinnitus, but during the last two years she had at times felt slightly giddy.

The absence of marked vertigo was a noteworthy feature of this case, and would seem to make it probable that the disease was confined to the cochlea. A hemorrhage into the cochlea, or embolism of the cochlear branch of the arter. auditiva interna, may have caused the deafness.

A CONTRIBUTION TO THE PATHOLOGY AND PATHOLOGICAL ANATOMY OF THE EAR.

By DR. A. HEDINGER, OF STUTTGART.

Translated by EDWARD FRIDENBERG, M.D., New York.

IN view of the rarity of cases of fatal aural disease, in which clinical observation has been supplemented by careful post-mortem examination, the following communication, giving, in addition to the clinical history, the results of a careful anatomical examination in each case, may prove of interest.

The pathological specimens are four in number:

1. *Acute suppurative inflammation of the middle ear* on the left side, with perforation of the transverse sinus, the superior petrosal sinus, and the dura mater.
2. *Caries of the temporal bone* on the left side.
3. *Sclerosis of the middle ear* on the right side, *ankylosis* of all the ossicles.

Specimens 2 and 3 are derived from the same case, one of pulmonary phthisis.

4. *Aural hemorrhage* from the retro-maxillary fossa, due to a laceration of the external jugular vein and of branches from the internal jugular vein, the laceration being caused by a traumatic detachment of the cartilaginous portion of the external auditory canal from the bony portion. Death due to internal complications.

CASE I.—*Acute suppurative inflammation of the middle ear.*

History.—At the time of his admission to the "Katharine Hos-

pital" the patient, a man of powerful physique, had been suffering for several weeks. On admission: moderately high fever; a circumscribed painful swelling of the left parotid gland, in which indistinct fluctuation was felt on deep pressure, especially between the mastoid process and the ascending ramus of the lower jaw. A deep incision being made at this point, no pus was found. A second incision on the following day gave vent to a few drops of thick pus. On pressure over the swelling a large amount of pus now issued from the external auditory canal, the floor of which was bulged forward. The case seemed to be one of caries of the temporal bone. The attending surgeon, Dr. Von Gärtner, presuming an implication of the mastoid process in the disease, removed a piece of bone about the size of a pea by chiselling, without, however, finding pus. After lying in complete coma for twenty-four hours, the patient died.

Autopsy.—Much pus was found under the dura mater and in the arachnoid sac. The superior petrosal sinus was filled with cheesy pus and thrombi, and was the seat of an ulceration, ten *mm.* in length and three *mm.* in breadth. This ulcer communicated with the pyramid below the semicircular canals by means of an opening in the bone, through which a probe passed directly into the tympanic cavity and into the mastoid antrum. The transverse sinus was the seat of an ulceration, three *cm.* in length, ten to fifteen *mm.* in breadth. The ulcer was covered with cheesy pus, and its margins were prominent and eroded. The pia mater and arachnoid were intensely hyperæmic; remaining shreds of dura mater were thickened. There was marked hyperæmia, vivid injection, and some thickening of the tegmen tympani.

Above the antrum was a defect in the bone about the size of a pinhead, through which the probe entered in a forward direction into the mastoid antrum, which contained cheesy pus. The drum-head was thickened and the seat of two perforations: the one near the centre was oval in shape; the other, situated more eccentrically, of an oblong shape. The tympanic mucous membrane was thickened and granular. The malleus and incus were well preserved and of normal mobility.

The external auditory canal was narrowed throughout to a slit, and the bony portion was carious. The membranous labyrinth and cochlea were infiltrated and thickened. The facial nerve was not recognizable. At the apex of the mastoid process was a bony defect of the size of a pea.

Remarks.—The discharge of the pus into the lateral sinus, as well as into the superior petrosal sinus, was probably due to the small size of the openings found in the membrana tympani. In the earlier stages of the disease an incision into the drum-membrane connecting the two perforations might have provided sufficient drainage.

The sclerosis of the apex of the mastoid process explains the failure of the operator to find pus. Even with a normal mastoid process death could not have been prevented, as the erosion of the bony walls of the two sinuses showed that they had contained pus for a long time, and the shortest road to a free surface was in the direction inward.

In the absence of sclerosis a part of the pus might have found an exit in a downward direction. The sclerosis, however, was evidently not of a secondary character, *i. e.*, not caused by inflammation of the mastoid cells.

The supreme importance of this specimen lies in the fact that it shows how dangerous it would have been to open the mastoid process at the spot usually selected. In this case the operator would have simply fallen into the transverse sinus and caused immediate death.

CASE 2.—*Caries of temporal bone. Left ear.*

History.—The patient, a very nervous girl, with a family history of phthisis, had been subject to repeated attacks of hæmoptysis for several years. Three years ago she came to my clinic complaining of loud but painless noises of a roaring and tapping character in the left ear. The records read: Otitis media catarrhalis acuta dextra; pharyngitis et rhinitis chronica.

Status Præsens.—Right ear apparently normal. Hearing distance after compression-pump, $\frac{8}{10}$. Tube pervious; fine crepitating sounds during inflation. Left drum-membrane opaque in spots and sunken. On inflation of middle ear, dome-shaped protrusion of upper half of membrana tympani with injection of its vessels. Tuning-fork placed on the head is heard louder on the right than on the left side; held in front of the ears, it is heard better on the left side. Chronic catarrh of nose and pharynx. No subjective noises during inflation.

Treatment and Course of Disease.—The daily use of the compression-pump was regularly followed by the above-mentioned

dome-shaped protrusion of the upper half of the drum-membrane, with as constant a return to its sunken condition during the intervals. On the fifth day a paracentesis was made, after which the protrusion diminished in size by about one half; the tinnitus became less marked for a few days, while the hearing distance remained unchanged. An attempt at aspiration with my aspirator was unsuccessful. The hearing distance on the right side sank to 100-50; the roaring and tapping sounds grew louder again.

A second paracentesis gave vent to some mucus; a few days later the secretion became purulent, but the hearing distance, instead of increasing, sank to 30 *cm.*, while the subjective noises, which had previously been heard at times only, became continuous. They now sounded like the boiling of water in a kettle.

In spite of the careful use of copper, salicylic acid, boracic acid, and chloride of zinc, the suppuration continued, giving rise to polypoid granulations in the tympanum and excoriations in the meatus. Chloride of zinc acted most beneficially on the granulations, parts of which during its use were occasionally swept away by syringing; yet seven full weeks had elapsed before a moderate improvement in the secretion and in the general condition was attained.

It was now noticed that the mass growing from the upper wall of the canal, which had been taken for a polypoid growth, was really the protruded and degenerated remnant of the drum-membrane. A prolonged and mild course of treatment, with salicylic acid and boracic acid used alternately, reduced the suppuration to a minimum, and cured the patient completely and permanently of her most distressing symptom, the subjective noises in the ear. While the latter did not recur, a small pedunculated polypus, starting from the remnant of the drum-membrane, was noticed a few days later. After the removal of part of it with the snare, the galvano-cautery was applied several times, with fairly successful results. This was followed, however, by an increase in the otorrhœa, the development of new granulations, swelling of the glands below the ear, and frequent attacks of pain in the entire left half of the head, accompanied with vertigo. Further treatment proved unavailing, and as the patient presented herself but rarely, the external canal was soon filled again with granulations. Finally, she was admitted to the "Diaconissenhaus" as a consumptive, and died there six months later of pulmonary phthisis.

Autopsy.—Membrana tympani entirely destroyed; bony portion

of meatus softened ; bony portion of Eustachian tube considerably dilated ; tegmen tympani carious. Between bulbus venæ jugularis and bony portion of Eustachian tube two fistulæ leading into pyramid. Tympanum enlarged by caries and filled with pus ; in its walls are seen the orifices of innumerable carious sinuses. Anterior wall of canalis caroticus is destroyed by caries, so that the membranous wall of the artery projects into the tympanic cavity. The carotid artery contains a thrombus, which is attached to the walls of the vessel by connective tissue. Stapes slightly movable ; its base thickened by bony deposit. Malleus of monstrous size, and drawn backward and upward apparently by tensor tympani muscle. Auriculo-temporal nerve visible. Mastoid antrum filled with cheesy pus.

Remarks.—Apart from the consideration of the pulmonary complication, instrumental interference would have been unavailing in this case, in which there was no retention of pus. On the contrary, the drum membrane being destroyed, the passage was unobstructed. Hence the carious process must have been due to causes not amenable to operative treatment, and an opening into the mastoid antrum would have simply evacuated the cheesy pus contained in this cavity, without retarding the progress of caries in the remainder of the ear.

This case, like many others of which I have clinical and autopsical records extending over a period of seventeen years, goes to prove that the indications for the perforation of the mastoid process have not yet been defined and formulated with sufficient precision. The correctness of this view is shown by a recently published book by Bezold, on the "Corrosion-Anatomy of the Ear," a work based on the author's ingenious method of injection. A careful study of this book, combined with the knowledge derived from anatomical preparations from fatal cases of aural disease, ought to lead to conservatism in treatment.

CASE 3.—*Sclerosis of the middle ear.*¹

The autopsy showed ankylosis of all the ossicles of the right ear. Drum-membrane normal ; malleus, incus, and stapes absolutely immovable. The specimen further shows :

¹ In this preparation the saw passed through the meatus internus.

Plexus Jacobsonii ram. communicans cum plexu tympanico, which consists, as is well known, of :

1. Nervus carotico-tympanicus.
2. Nervus petrosus profundus minor et superficialis major.
3. Ramus communicans cum ganglio otico.
4. Ramus communicans cum petroso superficiali majori et ganglio geniculato.

Tensor tympani markedly thickened ; musculus stapedius much thickened, sending connective-tissue bands in various directions, *e. g.* to the incus and to the stapes ; the latter pocket-shaped. The chorda tympani was visible.

Section through the cochlea showed infiltration and thickening of the basilar membrane.

The entire specimen presents a typical picture of the sclerotic form of chronic middle-ear catarrh, which gradually leads to complete loss of hearing, and it also illustrates the inadequacy of our therapeutic resources.

As the hearing distance was normal one year before death, we must assume an unusually rapid development of the sclerosis during the latter months of life. This rapid development of the sclerosing process, which, fortunately, is only rarely met with in such a marked degree, explains the absence of subjective sensations, *e. g.*, subjective noises, a symptom which would not have been wanting had the labyrinth been correspondingly affected. In their absence we are furthermore justified in locating tinnitus aurium and other subjective aural phenomena in the labyrinth chiefly. That these are not due to affections of the intrinsic aural muscles, especially abnormal contraction of the tensor tympani, is evident in this case, in which both tensor tympani and musculus stapedius were the seat of marked pathological changes. It also shows the futility of tenotomy of the tensor tympani, a mode of treatment fashionable some time ago, but now in a great measure forsaken. Attention should also be called to the nerves, which were in this specimen uncommonly distinct and prominent. This condition was probably caused by the atrophy of the lining membrane of the middle ear.

CASE 4.—*Aural hemorrhage.*

E. B., male, aged twenty-seven, fell from a roof, and died four hours later. Profuse hemorrhage from left ear. Separation of cartilaginous from bony meatus. Comminuted fracture of both knee joints. Venous hemorrhage from retro-maxillary fossa through external meatus. Rupture of spleen with internal hemorrhage.

Autopsy.—Marked injection of external ear and surrounding tissues. Meatus filled with coagula. External surface of temporal bone uninjured and normal, with the exception of marked venous hyperæmia of the periosteum. In the retro-maxillary fossa large extravasation of blood into and between the various tissues, rendering them indistinguishable.

At 1 cm. from the external meatus there is a detachment of the cartilaginous portion of the meatus from the bony portion, in the shape of a hole the size of a bean, infiltrated with blood and involving the entire anterior half of the meatus. Part of tegmen tympani translucent. Membrana tympani entire, dark blue in color, sunken inwardly, and almost in contact with the promontory, nearly obliterating the cavity of the tympanum, which is normal and contains no blood. Pneumatic spaces of temporal bone very hyperæmic. Eustachian tube contains a little watery secretion.

Aditus ad cellul. mast. normal; meatus auditor. int. and cochlea normal.

Remarks.—The hemorrhage from the ear was evidently caused by the rupture of the external jugular vein and probably also of the internal jugular vein, the blood from which found its way into the meatus through the aperture formed by the separation of the bony and the cartilaginous portions of the meatus. Death was due not to the aural hemorrhage but to the lesion of the abdominal viscera.

Ten years ago a specimen, very similar to the above in all respects, was referred to me for examination from the city hospital. In this case there was also a fracture of the base, not implicating the bony portion of the ear, with detachment of the cartilaginous from the bony portion of the meatus, and here, too, a profuse hemorrhage had occurred from the ear, although there was no lesion of the drum-membrane, of the middle ear, or of the internal ear. This point is of great importance from a medico-legal

point of view, as it has been customary to give a bad prognosis in all cases of aural hemorrhage following injuries to the head.

Aural hemorrhage may furthermore be caused by a fracture of the anterior wall of the meatus, due to impaction of the articular process of the lower jaw in its socket, an injury usually caused by a blow on the chin. My specimen shows conclusively that hemorrhage of this kind is not always moderate in amount, as stated by Koenig in his hand-book of surgery. Aural hemorrhage may therefore be presumed to proceed from the base of the skull only when the drum-membrane is ruptured, and the hemorrhage is both profuse and protracted.

An interesting case, probably belonging to the same category, was observed at the "Katharinenhospital" during 1870.

The patient, a male, aged fifteen, fell a distance of 20' striking on the right temple. Profuse bleeding from right ear and from both nares. On recovering consciousness after a few minutes, the patient vomited repeatedly. Examination (not by myself) revealed nothing but pain on pressure over right mastoid process. Three days after admission the patient insisted on leaving the hospital in spite of the protests of the attending physician, and went to work. He was not heard from again.

The bleeding from the ear and the pain on pressure in the mastoid region were probably due to a detachment of the cartilaginous portion of the meatus from the bony portion. These cases will be more clearly understood by a comparison with the following case, which is diametrically opposed in nearly all its features.

A man, while intoxicated, fell from the third story. He did not recover consciousness and died the day after. A small quantity of bright-red blood escaped from the ear. The autopsy was made hurriedly, but we are justified in presuming a rupture of the drum-membrane and a lesion of the labyrinth, from the fact that the brain and its membranes were markedly hyperæmic, and the left anterior cerebral fossa contained a large blood-clot. The

temporal bone on the left side was detached from the occipital bone, leaving a space a full line in breadth. The lungs were œdematous, the heart and the abdominal viscera exceedingly soft.

In this case we find fracture of the base with slight hemorrhage, in the others no fracture of the base but profuse hemorrhage, not arising from the internal ear or from the cranial cavity.

A CASE OF IVORY EXOSTOSIS OF THE ETHMOID CELLS—EXTIRPATION FROM THE ORBIT—DEATH—AUTOPSY—REMARKS.

By H. KNAPP.

(With five wood-cuts.)

THE ARCHIVES OF OTOLGY, not confining their sphere to the auditory organ alone, but paying due attention to the pathology of the nose and pharynx, in which a large percentage of ear-disease originate, are, I think, a suitable place for communicating the history of the following case to those who take particular interest in such affections. It might with propriety be reported in an ophthalmological or a general medical journal, for a prominent feature of the disease was the encroachment of the osseous growth on the orbit, while its starting-point was the mucous membrane of the nose, where chronic inflammation led to the formation of polypi and an osteoma, and later to retention and degeneration of pus in the adjacent cavities, particularly in the sphenoid cells, a morbid condition which with an ordinarily innocent operation served to determine a fatal meningitis. The case under consideration furnishes a striking example that those physicians who in the progress of their career are impelled to devote themselves mainly to the cultivation of a special department of medicine, will, by nature herself, never be permitted to entirely divert their attention from the general system.

The history of the case is as follows:

Mrs. J. C., æt. forty-seven, of Ilion, N. Y., consulted me, Oct. 11, '83, for nasal polypi and orbital tumor. She looked some-

what delicate, but seemed to be in good general health. She had suffered for ten or twelve years from nasal polypi, for which she had been operated on several times, first in 1873, when she had only two of them. In 1876 she had a great many polypi removed without material relief. In 1881 a great many were again removed. For four months she felt comfortable. Then she noticed that the polypi grew again, increasing steadily until, at the time she presented herself, they had completely obstructed the left nostril, pushing the nasal septum into the right nostril in which, also, several polypi were located. Four months previously she had for the first time noticed on the nasal side of the left orbit a tumor which, increasing steadily, was now about as large as a cherry, of bony hardness, and immovably connected with the os planum. The eye was slightly displaced, but otherwise not affected.

My opinion was that both nasal cavities, particularly the left, were filled with polypi, and that the orbital tumor was either an expansion of the ethmoid cells by the polypous growths, or a more or less solid osteoma, springing from the wall of these cells. It seemed rational first to remove as much of the polypi as could be reached from the anterior and posterior nares, then to attack the ethmoido-orbital tumor through an opening made in the inner wall of the orbit, which opening, after the removal of the solid tumor, might be made available to clear the posterior and upper parts of the nasal cavities, as well as the frontal sinus, of the growths which probably would be found there likewise. Knowing by personal experience how difficult and frequently impossible it is to remove soft pseudoplasms from the pneumatic cavities surrounding the orbit, and fully appreciating the responsibility involved in the case under consideration, I advised the patient to ask Dr. R. P. Lincoln of this city to take charge of the removal of the polypous growths, stating that I was quite willing to undertake the removal of the hard tumor encroaching upon the orbit, if it should prove impossible or impracticable to remove it from the nose. I referred the patient to Dr. Lincoln, as I had at the last meeting of the American Laryngological Society seen him exhibit some patients in

whom he had removed large growths from the posterior nasal space so successfully that his procedures were highly commended by the society. (See *Arch. Laryng.*, iv., 4.)

Dr. Lincoln was kind enough to give me the following notes on the operations performed by him:

"Oct. 11, '83. I removed at my office, with a wire *écraseur*, a large part of the growths from each nostril, but did not complete the operation because of the great number present and the unusual amount of hemorrhage, though this was by no means excessive.

"During this *séance* the septum *naarium* was found to be deviated to the right side. There was also discovered high up in the left nostril, on its outer aspect, a hard, immovable tumor, which was opposite to and evidently connected with the osseous tumor in the corresponding orbit.

"On the 15th and 18th the operation was continued, when the passages were apparently fairly well freed from polypi.

"As a result unimpeded nasal respiration had been secured and also a condition favorable to the contemplated operation for the removal of the orbital tumor.

"The amount removed by the wire was sufficient to fill a three-ounce bottle.

"The whole mucous membrane seemed to be a bed, from every conceivable point of which sprouted polypi of varying size. To remove them thoroughly was evidently a task requiring much time and perseverance. (The autopsy, however, afterward showed it to have been impossible.) It was therefore decided by the patient, with my approval, to discontinue the completion of this part of the treatment until the tumor in the orbital cavity had been operated on, after the recovery from which, we hoped, at the patient's convenience, to resume the eradication of the nasal polypi.

"Nov. 3d. Crystals of chromic acid were applied to the points of attachment of the polypi wherever practicable, and a cleansing and disinfecting wash containing carbolic acid and salicylate of soda was given the patient, to be used by herself."

Nov. 7th. The condition of the patient was as follows: Both nostrils were virtually free. The inner wall of the orbit projected toward the temple, so as to form a bony-hard tumor of about 8 mm. transversely, 25 mm. vertically, and 25 mm. antero-

posteriorly (*f. g. fig. 2*). The eye moved freely. In the upper part of the left nostril a hard, bony mass was felt, apparently the continuation of the orbital tumor. The eye was slightly pushed outward and forward (about 2 mm.).

The background of the eye ophthalmoscopically showed hyperopia $\frac{1}{5}$, the visual acuteness was $\frac{2}{80}$; that of the other eye $\frac{3}{80}$, and its refraction emmetropic. The vision of the left eye was not improved by cylindrical or other glasses. The optic-nerve entrance appeared very slightly raised. The retina showed in the neighborhood of the optic disc a peculiar corrugation in the shape of parallel curves the concavity of which was turned toward the optic disc, a picture such as I had never seen before. It was no detachment, but could be likened to the wrinkles in a healthy skin. On the nasal side there were several atrophic patches in the choroid. The background of the other eye was normal.

I performed the operation in the afternoon of Nov. 7, 1883, in the presence of Drs. H. B. Sands, Geo. F. Shrady, R. P. Lincoln, and several other physicians, at the N. Y. Ophthalmic and Aural Institute, assisted by the assistant surgeons, Drs. Pooley, Born, and D'Oench. The patient was kept under the influence of ether during the whole operation.

A curved incision was made from the junction of the middle and inner thirds of the brow, along the orbital margin toward the nose, down to the inner-lower corner of the orbit. It severed the tissues down to the bone, and at once exposed an ivory tumor piercing the os planum. The curved flap of integument was detached as a whole from the tumor, the nodular surface of which was carefully freed from the periosteum with a small hand chisel. The os planum all around the tumor was broken down with the same instrument. From its upper border some drops of thick pus and some polypoid masses escaped. The tumor was now grasped with a strong pair of bone forceps, but could not be pulled out before its connections with the bones of the ethmoid cells and with the nasal septum had been severed with the chisel. During the extraction of the tumor, which was done slowly and with slight rotatory movements, the periosteum of the nasal part of the tumor was gradually detached, so that the osseous mass came out as a whole, and perfectly clean.

The exploration of the wound showed the orbit and nasal cavity smooth and free from pseudoplasms, but from the frontal

sinus, which opened by a perforation of about 4 mm. in diameter, a soft polypus was projecting. It was scraped out with a sharp spoon, and proved to be a mucous polypus of 25 mm. in length, 20 mm. in breadth, and 4 mm. in thickness. The cavity of the sinus was explored with the spoon, but, aside from a very considerable enlargement, revealed no further abnormality.

I performed the operation without special antiseptic precautions, since experience has taught me that in this locality they are superfluous. An antiseptic dressing of the wound would have been an illusion anyhow, as the current of air during respiration passed through the cavity of the wound.

The whole external wound was closed with silk sutures, no provision for drainage being necessary, as the secretion could escape freely through the nose. A compressive bandage of absorbent cotton was applied over the eye and the region of the wound.

Nov. 8th. Patient felt comfortable the first twenty-four hours.

Nov. 9th. She passed a fairly good night, complaining, however, of some headache. Pulse 96. No rise of temperature. In the evening the headache increased, pulse quick. 0.36 quinine given.

Nov. 10th. Restless night, intense headache, thirst; temperature at noon 104.2° F.; pulse 96. Patient drowsy. Wound syringed out, through nose, with lukewarm salt water. No odor; no secretion; moderate swelling of lids, no swelling of conjunctiva; eyeball normal; vision good. Temperature in the evening, 102°. Patient answers questions slowly. 11 P.M. Patient difficult to arouse; occasional spasms of hands.

Nov. 11th. Patient more and more somnolent during the night; at 9 A.M. perfectly comatose, breathing rapidly. Pulse 160; temperature 104.6°. Ice applications to head. Stimulants. Patient continued to sink, and died at 11.30 A.M.

The *autopsy* was made in the afternoon of the same day by Dr. Prudden, Dr. Lincoln, and myself.

The cranium and dura mater were normal. The longitudinal sinus contained a small recent clot. The pia mater of the convexity on the right side was everywhere infiltrated with serum and pus, most intensely over the vertex. The convolutions were flattened. On the left side (that of the operation) the pia was likewise infiltrated with serum and pus, and the convolutions were flattened,

but less than on the right. The sero-purulent exudation was most marked along the longitudinal sinus, but well seen also along the large veins. On the base of the cerebrum was a moderate purulent infiltration of the pia, less on the left than on the right side, most marked along the larger vessels. The cerebral arteries were normal, except that a circumscribed collection of pus surrounded the right posterior cerebral. There was considerable serous infiltration in the left hemisphere, less in the right. The left lateral ventricle contained a large teaspoonful of bloody serum. The ependyma of both lateral ventricles was deeply congested, otherwise normal. Third and fourth ventricles unchanged. Substance of the cerebrum hyperæmic, that of the cerebellum and medulla the same in a less degree, otherwise normal.

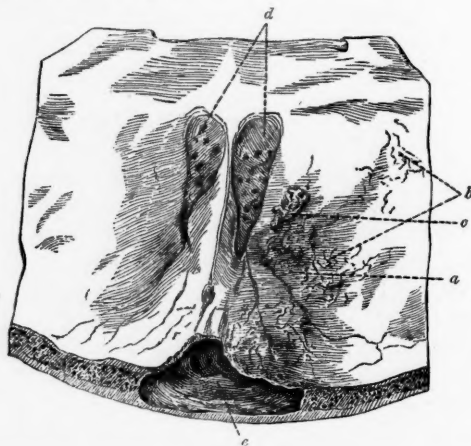


FIG. 1.

The cranial surface of the roof of the left orbit, near the crista galli, was blackish (fig. 1, *a*) to the extent of 3 *cm.* antero-posteriorly and 2 *cm.* laterally. The surface of the bone was smooth, but numerous small blood-vessels (fig. 1, *b*) were seen as short thin red lines to run through the superficial stratum of the bone, whereas but a few were visible on the other side. The bone was most discolored, and also some-

what rough, at the junction of the lamina cribrosa with the horizontal process of the left frontal bone, and there a portion of fibrous tissue containing a blood-vessel (fig 1, *c*) pierced the bone, connecting the dura mater with the lining membrane of the left frontal sinus.

A portion of the frontal bone [fig. 1, superior (cranial) surface; fig. 2, inferior (nasal) surface;] was removed with saw and chisel, comprising the roof of both orbits, the lamina cribrosa (fig. 1, *d*), the ensiform processes of the sphenoid, 2 cm. of the vertical plate of the frontal, and the upper portion of the ethmoid (fig. 2) from the back of the nose to the body of the sphenoid. This piece, containing the whole region

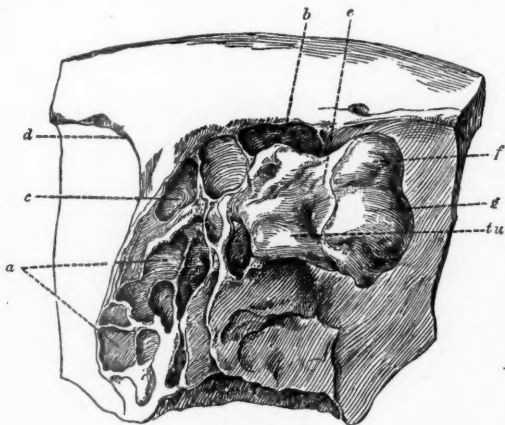


FIG. 2.

of the operation, was preserved for closer study. It laid the sphenoid and ethmoid (fig. 2, *a*) cells bare, and gave access to the left frontal sinus from above (fig. 1, *e*) and below (fig. 2 *b*). The right sphenoid sinus was empty, the left completely filled with an inoffensive soft cheesy substance, evidently penned up and decomposed pus and mucus, for the entrance to the sinus was plugged by means of a mucous polypus. (A few drops of similar substance had escaped through the upper part of the wound during the operation.)

The ethmoid cells on both sides were filled with polypi in all their numerous recesses.

The left frontal sinus (fig. 1, *e*) was enormously enlarged in every direction. It crowded the septum toward the right side, and extended between the outer and inner tables of the frontal bone, 5 *cm.* in the vertical, 3 *cm.* in the lateral, and 3.5 *cm.* in the antero-posterior direction, that is, as far as the blackish discoloration of the roof of the orbit. Its depth was greatest, 8 *mm.* in the middle line, between the eyebrows. It was partially filled with polypi, which, located in the lateral and posterior extensions of the cavity, had escaped the spoon during the operation. The right frontal sinus was of normal dimensions, empty, and communicated by a 6 *mm.* long, 5 *mm.* broad, opening (fig. 2, *c*), with the ethmoid cells near the upper-inner corner of the orbit (fig. 2, *d*).

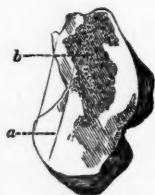


FIG. 3.

The contents of the left orbit were unchanged. The cellular tissue at the inner wall was congested, but free from inflammatory infiltration. The wound in the skin was well united, likewise free from infiltration. The tissues in the ethmoid cells from which the tumor had been removed were deeply congested, but free from purulent or any other alteration. At the nasal septum there was a round rough space, 12 *mm.* long, 8 *mm.* broad, evidently the basis of the osteoma.

The osseous tumor (fig. 2, *tu*, presenting the tumor in its natural situation), which had been removed by the operation, had an irregular, nodular shape. It measured 15 *mm.* at its base, 27 *mm.* vertically at its orbital end, and from 12 to 15 *mm.* antero-posteriorly. It was constricted in the middle (fig. 2, *e*), where the os planum had encircled it like a

collar. The orbital portion, which was the larger, was curved forward, and presented two knobs (fig. 2, *f, g*) separated by a horizontal furrow on the anterior surface.

The tumor (fig. 3) consisted, as was seen on a transverse section, for the greater (external) part of compact ivory-like bone (fig. 3, *a*); the smaller central part (fig. 3, *b*) was cancellous and vascular, of delicately spongy texture.

REMARKS.

The death of the patient was caused by acute purulent lepto-meningitis, which followed immediately upon the operation, and no doubt was induced by it. The pathogenesis is the same as the meningitis from mastoid disease with which we are so familiar. The cavity which paved the way from the site of the operation to the membranes of the brain was the left frontal sinus. This must have long been the seat of inflammatory action for it was distended in every direction. The polypous growths and the muco-purulent secretions retained in it enlarged in their increase the cavity by encroaching upon and destroying the diploëtic substance of the frontal bone, thus separating the inner from the outer table to a considerable extent. That the walls of the frontal sinus were in an inflammatory condition, and did not merely contain polypi, was demonstrated by the thick, purulent secretion which escaped when, during the operation, the sinus was opened; moreover, it was demonstrated by the condition of the bone substance. The black discoloration near the cribriform plate evidently was the result of an old process, whereas the hyperæmia in its neighborhood, still indicated in the specimen by the numerous congested blood-vessels visible in the superficial layer of the roof of the orbit, may have been of recent date. The pus contained in the left sphenoid sinus, resembling the cheesy substance so often found in the mastoid cells, was doubtless a very old formation, but so well locked up that it could not have had a direct influence on the intracranial inflammation. Its indirect influence, however, cannot be disregarded, for the presence of a collection of degenerated and decomposed

organic material in the vicinity of the field of the operation might have infected the wound. Yet this supposition had to be rejected on account of the perfectly aseptic aspect of the wound. The starting-point of the meningitis evidently was the frontal sinus. The diseases of this cavity, especially suppuration, have for more than a hundred years received deserved attention from medical writers, in proof of which I need only refer to the exhaustive paper of Steiner in *Langenbeck's Archiv für Chirurgie*, Bd. xiii., 1, p. 144, 1871.

In my own practice I have come across a certain number of cases of suppurative inflammation of the frontal sinuses. The majority of them recovered, after a spontaneous or surgical opening had given exit to the pus. Two cases terminated fatally in spite of the evacuation of pus at the orbital margin. In the one, the autopsy discovered an abscess in the frontal lobe¹; in the other, the patient died² under the same symptoms of abscess in the frontal lobes, but no autopsy was had. In one case, that of a young man, A. St., the opening (Feb., 1878) at the superior inner angle of the orbit, which bulged like an osteoma, liberated a large quantity of thin pus, and the exploration with a spoon discovered a large mucous polypus in the posterior recess of the sinus. It was removed, the cavity was syringed and drained eight months, then allowed to close, and a permanent cure was obtained.³ This case, as far as the disease of the frontal sinus is concerned, bears a great resemblance to the one under consideration.

Much less frequent than polypi and suppuration is the development of **osseous growths** in the pneumatic cavities in and around the nose. In a paper read three years ago before the N. Y. State Med. Society I compiled all the cases of osteoma of the frontal sinus that I could find in

¹ Described in ARCHIV. OF OPHTH., vol. ix., June, 1880.

² Aug., 1883. Mr. Whitlow, a colored man, of twenty-four years, had a large abscess at left brow. An incision evacuated a great quantity of pus. Cerebral symptoms followed for four months, then death. Only the uncertainty of locating the seat of the intracranial disease, *i. e.*, the supposed abscess, deterred me from opening the skull.

³ The case is described in ARCHIV. OF OPHTH., vol. ix., June, 1880. The gentleman has been well ever since.

literature. They were eleven in number. The operation had proved fatal in all but two. Since that time another case has been operated on and published by Tweedy.¹ I had the privilege of witnessing this operation. It proved likewise fatal by meningitis. A case operated on successfully by Richet has to be added to the above number. Cases of exostosis originating in the ethmoid cells are more numerous. They are comprehensively described in J. Solis-Cohen's text-book on the "Diseases of the Throat." Cohen bases his description principally on the admirable little pamphlet by Dr. Paul Ollivier: "Sur les Tumeurs Osseuses des Fosses Nasales et des Sinus de la Face," Paris, 1869. It is not my intention in this place to collect the literature on the subject, since this task, to a certain degree of completeness, has been done by R. Berlin in *Graefe-Sæmisch's Handbuch der Augenheilkunde*, vol. xvii., p. 725, 1880.

If we ask **what constituted the danger** in our case, what in particular **caused the death** of our patient, I would answer as follows: The chronic inflammation in the pneumatic cavities of the upper part of the face had led to a distension of the left frontal sinus and rendered its osseous wall congested and porous (ostitis) with beginning necrosis. The enucleation of the exostosis of the ethmoid cells, the opening of the frontal sinus, and the scraping out of its contents with a sharp spoon, had produced a sufficient irritation in the diseased walls of the sinus to incite a purulent meningitis. I abstain from the easy task of explaining the pathogenesis of the disease according to the modern views on infection. I want to remain on the basis of clinical experience.

Was the **enucleation of the osteoma in itself the dangerous factor**? R. Berlin (*l. c.*) considers the removal of osteomas to be an exceedingly dangerous procedure, as twenty-five per cent. of the cases compiled by him ended fatally. I have operated on five cases of exostosis of the orbital walls and the neighboring cavities. Two ended fatally,—a worse percentage. In spite of all this, I cannot hold the operative traumatism responsible for these un-

¹"Royal London Ophth. Hosp. Reports," vol. x., pt. iii.

favorable statistics. In the case of an exostosis of the frontal sinus I opened this cavity much more extensively, and used the chisel a full hour before the operation was completed; the tumor was larger than the one under consideration, no antiseptic substances had been used, yet the wound healed by first intention, and the patient to-day, four years later, is well and hearty, without a trace of his disease,—even the scar in the skin is perceptible only on close inspection.¹

The most striking evidence that the traumatism in itself is not the dangerous element is furnished by the famous case published by Maisonneuve in the *Gaz. des hôp.*, 1863, p. 458. An ivory exostosis, springing from the ethmoid cells, had filled the whole orbit and pushed the eyeball completely out of its socket (fig. 4).² It was enucleated, with-

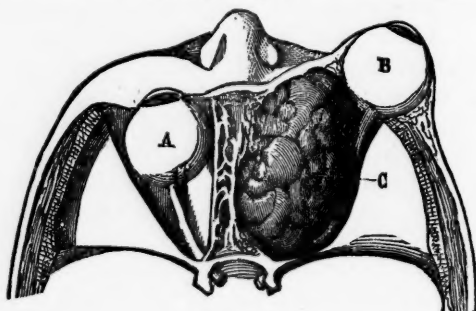


FIG. 4.

out antiseptic precautions, through an incision along the inner part of the brow down the side of the nose as far as the lower margin of the orbit. The eye was replaced and regained perfect mobility and sight. The wound healed, without fever, by first intention. The tumor (fig. 5) weighed 90 grammes, its antero-posterior dimension was 62 mm., its transverse diameter 40 mm., its vertical diameter 72 mm., its greatest circumference was 170 mm., its smallest 140 mm. Its surface was mammillary, very uneven. Now,

¹ Described in ARCH. OF OPHTHAL., vol. ix, p. 464, etc., 1880.

² Figs. 4 and 5 are reproduced from Maisonneuve's original publication. Fig. 4 is schematic; fig. 5 from a photograph. Figs. 1, 2, 3, 4, are life-size.

if tumors of such size can be successfully removed, neither the locality nor the traumatism can constitute the real danger.

The real element of danger is the long-prepared, diseased condition of the tissues surrounding the tumor. Where this exists, the operation may be the inciting cause of the meningitis or encephalitis—in other words, may give the impulse for the extension of the disease into the cranial cavity. The majority of these cases will, however, terminate fatally even though left alone. Proof—the mortality from chronic mastoid disease. Schwartze's eleven per cent. of death from opening the mastoid, in a series of 100 cases,

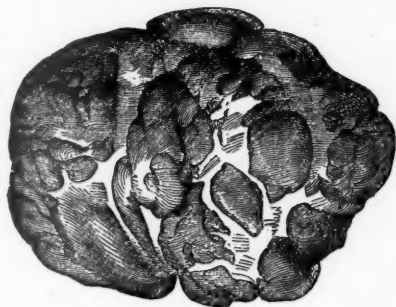


FIG. 5.

demonstrate the same proposition. Chiselling through healthy bone is not dangerous, whereas the consequences of chronic suppurative mastoiditis are of the gravest nature.

The practical rules to be deduced from the history and post-mortem condition of the case under consideration and from the study of similar cases are:

1. Nasal polypi, if allowed to grow, may multiply and spread to such an extent that their removal becomes utterly impossible.
2. They may cause chronic inflammation of the osseous walls and distention of the pneumatic cavities, the most important of which are the frontal sinuses.
3. Osseous tumors, which develop in comparatively

healthy pneumatic cavities, can be removed with safety,—that is to say, the operative traumatism does not constitute an element of particular danger.

4. The removal of osseous tumors from pneumatic cavities with diseased osseous walls, is dangerous by causing the inflammation to extend into the cranial cavity, and often proves fatal by acute (traumatic) meningitis and encephalitis.

TABLES SHOWING THE RESULTS OF AN EXAMINATION OF THE HEARING POWER AND MEMBRANÆ TYMPANI OF ONE HUNDRED AND FORTY-SEVEN DEAF-MUTES, WITH A STATEMENT OF THE CAUSES ASSIGNED FOR THEIR LOSS OF HEARING.

By D. B. St. JOHN ROOSA.

IN the year 1867, in conjunction with the late Dr. George M. Beard, I examined 296 deaf-mutes with a view of contributing something to our knowledge of the causes of deaf-mutism. The results of these examinations were meagre, and they were made to appear even less complete than they were in reality, because the editor of the journal in which they were published¹ could not give us the space to publish the tables upon which our conclusions were founded, and because the tables were lost so that they could not be published elsewhere. Since the use of the tuning-fork has come to play such an important part in aural diagnosis, it has been made available also in the examination of deaf-mutes. De Rossi,² of Rome, has made the most complete examinations of which I know, as to the hearing-power of deaf-mutes. He examined seventy individuals with the speaking-tube and tuning-fork. Twenty-seven heard the voice, four the watch, thirty-nine the tuning-fork vibrating in the air. Nearly all of the seventy perceived the vibrations through the bones, eleven only had no perception by bone-conduction, and De Rossi found

¹*American Journal of the Medical Sciences*, vol. liii., p. 399.

²Relazione sopra l' Ospizio dei Sordi-Muti de Roma. Quoted by Hartmann. "Deaf-Mutism." Translation, p. 84.

only three cases of what he termed total deafness. These examinations of De Rossi seem to me to furnish more reliable data than the cases of Toynbee and Kramer, and chiefly because the examination by the tuning-fork and speaking-tube was not made by them. Accordingly, I have imitated the examinations of De Rossi in those I have made. The imitation was an unconscious one, however, for it was not until I had nearly finished my examinations, that I found from a scanty reference in Hartmann's book on deaf-mutism, that De Rossi had preceded me in these tests.

While, as an otologist, I have but little interest in the modes of education of deaf-mutes, a description of which forms so much of what is said about them, I am exceedingly anxious to learn the seat of the lesion which causes the deafness, as well as the exciting causes of the aural disease and the hearing power. The tuning-fork seems to me a very important means of determining the seat of the lesion in cases of impairment of the hearing in which mutism does not result. I was desirous to know what it would indicate in those who are dumb as well as deaf. I found in the institution for the improved instruction of deaf-mutes in this city, the most ample opportunities for examinations. Every facility was afforded me by the principal, Mr. Greenberger, and I desire to thank him not only for the advantages he so liberally afforded me, but also for his valuable assistance given in a truly scientific spirit. I was also assisted by Dr. J. B. Emerson and Dr. George J. Bull, without whose aid, I should not have been able to accomplish the work of examining so many pupils. I used a "C" tuning-fork in the examination as to the aërial and bone-conduction. The tests by speaking-tube were made by Mr. Greenberger, and I have relied wholly upon his statements as to that point.

147 Cases of Deaf-Mutism.

TABLE I.—Causes Stated by Parent or Guardian.

	No.		No.
Born deaf	44	Whooping-cough	2
Cerebro-spinal meningitis .	27	Spinal trouble	1
Scarlet-fever	16	Mumps	2
Brain fever	13	Pneumonia	2
Meningitis	4	Gastric-fever	1
Measles	7	Cholera infantum	1
Fall on head	7	Intermittent fever	1
Unknown	7	Syphilis	1
Convulsions	4	Varioloid	1
Hydrocephalus	3		
Fever	3		147

In regard to this table, I can only say that it is as reliable as any that it seems possible to get from any institution. As far as the statements as to scarlet-fever, measles, cerebro-spinal meningitis, meningitis, mumps, and syphilis go, I think it may be considered trustworthy. When we enter the domain of congenital deafness, or such causes as "spinal trouble," "fall on head," "convulsions," there is great uncertainty as to the actual cause. Yet these causes are taken from blanks carefully filled out by the parents or guardians, many of them very intelligent people of the higher walks of life, who send their children to be under Mr. Greenberger's care. The causes are more accurately given, than in the other institutions in which I have made examinations. It will be seen there were only fifty-one cases, adding together the congenital and "unknown," or a little more than thirty per cent., which may, with much probability, be considered congenital cases. In our tables of 1867, we classified sixty-one per cent. as congenital cases. Hartmann's tables¹ show that of 8,404 deaf-mutes 5,546, or more than sixty-five per cent., were considered as congenital cases. His statistics are apparently made up largely of official and not personal examinations; for in the examinations made in Berlin by Hartmann himself, one hundred and eighty-five in number, only forty-five

¹ P. 64, *loc. cit.*

are classified as congenital cases; and those made by Cohn, in Breslau, show about the same proportion—that is, of one hundred and thirty deaf-mutes, fifty-seven are said to have been born deaf, while in other parts of Germany, and in Ireland, the proportion of congenital cases is much larger. I regard the official tables of all countries as valueless, except as to the total number of deaf-mutes. Those who collect them, are usually entirely incompetent for the sifting of evidence necessary to get even approximate truth upon this point.

TABLE 2.—RESULTS OF THE EXAMINATION WITH THE TUNING-FORK C³ OF 147 DEAF-MUTES.

<i>There was no aerial conduction on either side, while bone-conduction existed in</i>	74 cases.
<i>Bone-conduction on one side, both bone and aerial on the other in</i>	1 case.
<i>No bone or aerial conduction on one side. Bone-conduction on the other.</i>	10 cases.
<i>Bone and aerial conduction, both sides</i>	7 "
<i>Bone and aerial c. on one side; bone on the other</i>	13 "
<i>Neither bone nor aerial c. on either side</i>	12 "
<i>No bone or aerial c. on one side. Both bone and aerial on the other</i>	1 case.

118 cases.

In twenty-nine cases the subjects were so young or were otherwise incapacitated for intelligent answers, so that no conclusions could be formed, except that the large majority of them probably heard the tuning-fork by bone-conduction.

From this table I conclude that the impairment of hearing in seventy-four of the one hundred and eighteen cases was due to diseases of the middle ear alone. In twenty-six additional ears there was disease of the middle ear alone—that is, sounds were not heard through the air at all, but only through the bones. In twelve cases, or twenty-four ears, there was, I conclude, disease both of the middle and internal ears. In eleven additional ears there was also the same condition. In the seven cases and fourteen ears where there was both aerial and bone-conduction, I con-

clude that there was disease both of the middle ear and the nerve. In the thirty-five ears in which there was neither aerial nor bone-conduction, we may conclude either that there was disease of the nerve alone, or of both middle ear and the nerve—for disease of the cochlea of a complete type would probably obliterate the perception of sound. Yet even here disease of the middle ear might also exist. I will now present a series of tables made in consonance with the supposed cause of the deafness.

TABLE 3.—*Scarlet-fever being cause of deafness, condition of membrana tympani. 16 cases, 32 ears.*

Absent	1
Opaque and cicatricial	4
Sunken, opaque, small or no light spot	11
Perforate and ulcerating	9
Congested	2
Neoplastic and perforate	1
Neoplastic	2
Not well seen	1
Perforate, no discharge	1
	<hr/>
	32

Tuning-Fork Test.

No aerial conduction but bone-conduction	17
Bone and aerial conduction	3
No bone or aerial conduction	8
Unreliable	4

Age of patients at time of suffering from disease and becoming deaf:

From 2 to 3 years	2
" 3 " 4 "	8
" 4 " 5 "	3
" 5 " 6 "	1
" 6 " 7 "	1
" 8 " 9 "	1
	<hr/>
	16

There is in these scarlet-fever cases a large proportion—8, —or one in 4, where disease of the nerve certainly existed. It will also be remarked that there is a large proportion of

cases of ulcerative disease. That an ulcerative disease of the tympanum may more readily involve the internal ear than a plastic or catarrhal inflammation, is probably true. Yet the starting-point of otitis in scarlet-fever is usually the middle ear.

TABLE 4.—*Measles cause of deafness; condition of membrana tympani. 7 cases, 14 ears.*

Sunken, no light spot, opaque	5
Congested	1
Sunken light spot	1
Not well seen	5
Opaque, but good light spot	2
	<hr/>
	14

Tuning-Fork Test.

Bone-conduction but no ærial conduction	6
Bone and ærial conduction	1
No bone or ærial conduction	1
Unreliable	6
	<hr/>
	14

It will be noted that only one case occurs here of those of whom a reliable test could be made, in which it is possible that disease of the nerve alone exists—that is the case in which there was neither bone nor ærial conduction.

Age at which disease of deafness occurred :

Under one year,	3
From 1 to 2 years	3
" 2 " 3 "	1

TABLE 5.—*Cerebro spinal meningitis cause of deafness; condition of membrana tympani. 27 cases, 54 ears.*

Cicatricial	6
Opaque	6
Sunken, fair light spot	10
" good color	8
" small or no light spot	16
Not well seen	3
Opaque, good light spot	1
Cicatricial and perforate	2

Congested and sunken	1
Congested	1

 54
Tuning-Fork Test.

Bone-conduction only ; no ærial conduction	34
Bone and ærial conduction	5
Neither bone nor ærial conduction	8

 47

Unreliable	7
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Here the proportion of cases in which it may be conjectured that the nerve alone is involved, was not as large even as in scarlet-fever. There were only eight ears of a total of fifty-four, or about one in seven. It is in this disease, that an affection of the nerve has been often assumed to be the most frequent cause of the deafness.

■ My clinical experience has been against this view, and I believe that the few post-mortem examinations that have been made of persons with aural disease in cerebro-spinal meningitis, go to support the view of that experience, which is that a lesion of the middle ear, is in a large percentage of cases the cause of the deafness.

TABLE 6.—*Deafness said to be congenital ; condition of membrana tympani. 44 cases, 88 ears.*

Normal color and light spot	11
Sunken, opaque, or no light spot	34
Obscured by wax	10
Opaque, large light spot	1
Sunken, opaque, but good light spot	14
Congested, sunken, and small light spot	5
Obscured by narrow canal	6
Cicatricial and perforate	3
Opaque, calcareous	1

 88
Tuning-Fork Test.

Bone-conduction, but no ærial	48
Bone and ærial	8
Neither ærial nor bone	14
Unreliable	18

 88

Here the proportion of cases of nerve or central disease is quite high—fourteen to forty-eight, or a little more than one to three. Yet even here, disease of the conducting apparatus largely predominates.

TABLE 7.—“Brain-fever,” “inflammation of brain,” “meningitis,” and “congestion of brain” said to be the cause of deafness; condition of *membrana tympani*. 15 cases, 30 ears.

Sunken, opaque, small, or no, or double light spot	12
Normal	1
Sunken, good color, good light spot	7
Cicatrical	4
Not well seen	3
Perforate and ulcerating	3
	<hr/>
	30

Tuning-Fork Test.

Bone-conduction only	18
Aërial and bone	4
Uncertain	8
	<hr/>
	30

Age of patients when deafness occurred :

Less than one year	2
From 1 to 2 years	5
“ 2 “ 3 “	1
“ 4 “ 5 “	2
“ 5 “ 6 “	1
“ 6 “ 7 “	3
“ 8 “ 9 “	1
	<hr/>
	15

TABLE 8.—Fall on head cause of deafness; condition of *membrana tympani*. 7 cases, 14 ears.

Not well seen	5
Sunken, opaque, fair or good light spot	2
Sunken, no light spot	2
Good light spot but sunken	2
Sunken, congested	1
Good light spot	1
Small “ “	1
	<hr/>
	14

Tuning-Fork Test.

Bone-conduction only	8
Neither bone nor aerial	1
Bone and aerial conduction	1
Unreliable	4
	<hr/>
	14

TABLE 9.—*Cause unknown. 7 cases, 14 ears.*

Opaque, sunken, good light spot	4
Not well seen	1
Opaque	1
Good color, fair light spot	1
Small light spot	1
Opaque and sunken	2
Sunken, small light spot	2
“ good light spot	1
Opaque, good light spot	1
	<hr/>
	14

Tuning-Fork Test.

Bone-conduction only	10
Uncertain	4
	<hr/>
	14

TABLE 10.—*Convulsions cause of deafness ; condition of membrana tympani. 4 cases, 8 ears.*

Opaque, small light spot, good color	2
“ sunken, good light spot	2
“	2
“ small light spot	2
	<hr/>
	8

Tuning-Fork Test.

Bone-conduction only	5
Aërial and bone-conduction	3
	<hr/>
	8

Age at which deafness occurred :

Less than 1 year	1
From 1 to 2 years	3
	<hr/>
	4

TABLE II.—*Syphilis cause of deafness ; condition of membrana tympani. 1 case, 2 ears.*

R. M. T. much sunken, no light spot ; left slightly sunken, medium-sized light spot.

Tuning-Fork Test.

Right, no aërial conduction, but bone-conduction ; left, same.

In this case, the only one found, there was a syphilitic history ; notched teeth ; the subject has had interstitial keratitis. The disease seems to be confined to the middle ear.

TALBE 12.—*Hydrocephalus : condition of membrana tympani. 3 cases, 6 ears.*

Not well seen	1
Sunken, perhaps perforate	1
Sunken, small light spot	2
Opaque, no light spot	2
	<hr/>
	6

Tuning-Fork Test.

Bone-conduction only	6
Age :	
Less than one year	1
From one to two years	1
Unknown	1
	<hr/>
	3

TABLE 13.—*Spinal meningitis ; condition of membrana tympani. 3 cases, 6 ears.*

Not well seen	2
Sunken, opaque, good light spot	1
Opaque and cicatricial	1
Sunken, no light spot	2
	<hr/>
	6

Tuning-Fork Test.

Bone-conduction only	6
Age :	
From 2 to 3 years.	1
" 5 " 6 "	1
" 6 " 7 "	1
	<hr/>
	3

TABLE 14.—*Varioloid ; condition of membrana tympani.* 1 case, 2 ears.

Not well seen	1
Good color, good light spot, sunken	1
	<hr/>
	2

Tuning-Fork Test.

Aërial and bone-conduction	1
Bone-conduction only	1
	<hr/>
	2

Age at which deafness occurred : one year and four months.

TABLE 15.—*Pneumonia ; condition of membrana tympani.* 2 cases, 4 ears.

Sunken, small light spot	1
Not well seen	1
Opaque, sunken, no light spot	2
	<hr/>
	4

Tuning-Fork Test.

Bone-conduction only	2
Uncertain	2
	<hr/>
	4

Age :

Less than one year	1
From one to two years	1
	<hr/>
	2

TABLE 16.—*Whooping cough ; condition of membrana tympani.* 2 cases 4 ears.

Good light spot, sunken, opaque	1
Opaque, small light spot	1
Sunken, good color	1
Sunken and congested	1
	<hr/>
	4

Tuning-Fork Test.

Uncertain	1
Both aërial and bone-conduction	1
	<hr/>
	2

Age :	
" In infancy "	I
Whooping cough, intermittant fever at 2 years 9 months	I
	<hr/>
	2

TABLE 17.—*Cholera infantum ; condition of membrana tympani.*
1 case, 2 ears.

Sunken, no light spot	11
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Tuning-Fork Test.

Bone-conduction only	2
Age, one year.	

TABLE 18.—*Gastric fever ; condition of membrana tympani.* 1 case, 2 ears.

Sunken, opaque, small light spot	I
Sunken, good color, small light spot	I
	<hr/>
	2

Tuning-Fork Test.

Bone-conduction only and that feeble	2
Disease at 2 years and 8 months.	

TABLE 19.—*Intermittent fever ; condition of membrana tympani.* 1 case, 2 ears.

Small light spot	2
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Tuning-Fork Test.

Bone-conduction only	2
Intermittent fever and spasms at 2 years.	

TABLE 20.—*Mumps cause of deafness ; condition of membrana tympani.* 2 cases, 4 ears.

Right <i>Mt</i> opaque, small light spot ; left <i>Mt</i> , fair light spot, good color, sunken	I
R. <i>Mt</i> and L. <i>Mt</i> cicatricial	2

Tuning-Fork Test, Unreliable.

Age :	
A few months old	I
6 years	I
	<hr/>
	2

TABLE 21.—*Fewer cause of deafness ; condition of membrana tympani. 3 cases, 6 ears.*

Sunken, two light spots	2
Sunken, small light spot	2
Opaque, small " "	1
Cicatricial	1
	<hr/>
	6

Tuning-Fork Test.

Both ærial and bone-conduction	2
Bone-conduction only	4
	<hr/>
	6

Age :

9 months	1
5 years	2

TABLE 22.—*Cases in which words or letters could be heard through a speaking-tube placed in the ear ;¹ condition of membrana tympani. 16 cases, 32 ears.*

Opaque	6
Sunken	15
Good color	4
Good light spot	8
Small " "	6
No " "	6
Two " spots	1
Cicatricial	5
Calcareous	1
Vascular	1
Perforated	2
Not well seen	3

Tuning-Fork Test.

Both ærial and bone-conduction	4
Bone only	2
Bone both sides, ærial on one side	3
Bone and ærial on one side, neither on the other	1
Neither bone nor ærial on either side	2
Unreliable	4
	<hr/>
	16

¹ In this table the various appearances of the membrana tympani are noted without regard to the number of ears.

Disease Causing Deafness.

Born deaf	5
Measles	4
Cerebro-spinal meningitis	3
Brain fever	1
Convulsions	1
Scarlet-fever	1
Unknown	1

—
16

To this last table, the words of Mr. Greenberger should be added :

"The speaking-tube is used in these cases to assist the scholars to speak better after they have learned to pronounce them from the lips. There is not a pupil in the school who could be taught to speak a word from hearing it through the tube alone, but they will recognize words with which they have become familiar through lip-reading."

The complete tables of the 147 cases, with remarks upon many of them, will be published in the new edition of my work on the ear, now in the press. I am far from thinking that the tables here published form complete data, but I think they may assist in the determination of the lesions found in deaf-mutism. This much can be said at any rate : those who study them, will be looking upon a mirror reflecting what is seen on examining deaf-mutes who are intelligent enough to be educated. The deductions may be different, by different observers, but the facts will remain.

REVIEWS.

Die Corrosions-Anatomie Des Ohres. Von Dr. FRIEDRICH BEZOLD, Privatdocent der Ohrenheilkunde in München. Mit 6 Tafeln in Lichtdruck. Munich: Theodor Riedel, 1882. Reviewed by H. Steinbrügge, Heidelberg.

Bezold's work on the anatomy of the ear, as demonstrated by the corrosion method, is one of the books dedicated by the Medical Society of Munich to the Würzburg University, on the occasion of its anniversary festival; and it really presents a festive appearance as regards its exterior, the printing, and the plates. But in another respect, too, it deserves the appellation "festive," celebrating as it does the worthy conclusion of years of persevering labor and diligent study. As early as 1877, the Reviewer had the opportunity, at the meeting of German Naturalists and Physicians at Munich, in the Otological Section, to witness the interesting exhibition of numerous specimens of the human ear prepared by the corrosion process by Bezold. If we bear in mind that since that time the author has extended his views more and more by the preparation of new specimens, and by the often repeated examination and comparison of the same; and that he decided only a short time ago to publish the total results of his investigation, the above appellation chosen by us will certainly be admitted as justifiable.

It will hardly be questioned that this method of examining the temporal bone forms an almost indispensable supplement to the anatomical views gained from sections. The author proves this most clearly by the description of the external canal; the sections from which its lumen was formerly almost exclusively studied, were made in parallel places, and as they struck the basis of the curved canal only in parts, could no more give a picture of the canal that was true to nature than horizontal and vertical sections through the external meatus *alone* would enable us to form a correct idea of the dimensions of the narrow and wide portions.

Thus was verified Hyrtl's statement that sections are instructive only in cavities of *regular* form, that plastic casts alone are capable of faithfully reproducing all the irregularities of the cavities which constitute the middle ear. But if this was true of the cavities subservient to the sensory function, Bezold at once recognized that the corrosion method likewise must be the best means of studying the relation and connection of the pneumatic and spongy cellular spaces present throughout the temporal bone, the knowledge of which, with regard to the extension of pathological processes is, as is well known, of the greatest importance. The author has, therefore, directed particular attention to these spaces in the production of his casts; and as macerated temporal bones are especially adopted for making casts of these spaces, while for casts of the middle ear mainly specimens the soft parts of which had been preserved, were used, he makes a distinction between the corrosion anatomy of the soft parts and of the bones, and divides his paper accordingly; the first part comprising the *description of preparations of the soft parts obtained by the corrosion method, the second that of preparations of the bony parts obtained in the same way.*

The *first part* begins with directions for the preparation of such specimens, and in four subsequent sections contains the description of the auditory meatus, the tube, the drum cavity with the mastoid antrum, as well as of the remaining pneumatic spaces. If we may direct attention to some results of the investigation which are of material interest, it should be noted, first, in reference to the auditory canal, that Bezold makes its anterior wall commence at the margin of the tragus, from which results a double, zigzag bend of the canal, and instead of the usual assumption of four walls, based on the fact that cross sections throughout represent an almost oval shape, he describes only a posterior and an anterior wall which, to be sure, corresponding to the screw-like twist of the canal, change to postero-superior and antero-inferior ones at its inner end. The widest part of the meatus is found at its entrance, then it gradually becomes narrower, especially in height, to the inner end of the cartilaginous part; a second dilatation occurs rather suddenly, at the beginning of the osseous canal, which is again followed by a decrease in the diameter, particularly of the lesser one further inward. The anterior lower wall in the osseous part forms an almost even plane, while the posterior upper one maintains its vaulted shape, so that sections made vertically to the axis here represent not an

oval, but a tunnel form. If we imagine such a section carried through the farthest outward point of the posterior upper periphery of the membrana tympani (termed the external pole), then the shorter diameter (height) of the tunnel measures on the average only 4.6 mm. Hence there is here a considerable narrowing as regards the lesser diameter, which is not participated in, however, by the other, and the author correctly calls attention to the origin of the one-sided, partially erroneous statement, that a dilatation of the passage occurs at this point, because the view was generally based on horizontal or oblique sections, which struck the direction of the *greater* diameter. Upon these anatomical data are based the practical hints which the author adds here for the extraction of foreign bodies. After a brief discussion of the morphological varieties of the external canal, from which we learn that they become rarer in the direction from without inward, we find a tabular arrangement of the longitudinal measurement of the auditory canal and its several divisions, as well as of the diameters of the lumina throughout their extent, based on twenty-one specimens and averaged. The same table contains the measurements of both diameters of the membrana tympani, as well as the size of the angle formed by the membrane with the anterior inferior wall. The mean distance from the posterior edge of the entrance to the point of the umbo was found by Bezold to correspond pretty closely with v. Tröltsch's measurement, averaging 23.4 mm. The same harmony exists respecting the longer and shorter diameters of the membrana tympani. On the other hand, the longitudinal measurement of the cartilaginous portion of the posterior wall is surprisingly small, amounting to only 4.46 mm.

Bezold's method for determining the angle formed by the membrana tympani with the anterior wall is very interesting. It is shown that the greater diameter of the membrana tympani meets its above-mentioned external pole; the vertical distance of this point from the anterior lower wall (narrowest point, see above) can moreover be easily measured on casts, and a plane carried through these two lines would strike the anterior lower wall in such a way as to form an approximately right-angled triangle. Therefore the quotient of the greater diameter of the membrana tympani (hypotenuse) with the vertical line (opposite side) represents the sinus value of the angle in question. In this way the author calculated the angle on various specimens, and found it to be $27^{\circ} 35'$. If we could take as a basis the quotient of the average values of the *lines* mentioned, viz., $\frac{4.6}{9.2}$, we would

obtain the easily remembered number of 30° . Unfortunately the section of the anterior lower wall does not form an exactly straight line, but has a slight downward curve, so that the size of the angle would be rather less. The author also mentions Sappey's statement, who determined the angle to be only $20-25^{\circ}$. At any rate, these undoubtedly correct measurements differ considerably from those of other authors (Huschke, 55° ; Tillaux, 45°).

Of the Eustachian tube, the osseous part is adapted for making casts, but not the cartilaginous part, because the casts of the latter, if they succeed at all, represent the tube not at rest, but in a state of dilatation. After a thorough description of the preparations obtained by him, there follows on page 30 a second table, in which are given the longitudinal measurements of the tube, the height of the two ostia, the distance of the isthmus from these, and the dimensions of the latter. The numbers found correspond pretty closely with those given by previous writers. Surprising, however, is the result obtained in reference to the isthmus which Bezold found on the average 3 *mm.* high, while its transverse diameter in eight specimens out of twelve measured only $\frac{1}{4}$ *mm.* and even less, so that in many cases it seems to form merely a fine fissure; it is, therefore, not surprising that even the thinnest bougies are arrested there.

The drum cavity and antrum are considered by the author as one continuous space. As regards the form of the drum cavity, Henle's comparison of it to a low cylinder bounded by concave terminal surfaces appears most nearly correct. Inasmuch as, for the purpose of opening the *cavum tympani*, the roof is generally chiselled off, its inner surface is generally lost to the examination. For this reason it is probably but little known that a bony ridge, the "*crista transversa tympani*," as Bezold calls it, runs transversely over the centre of the roof of the drum cavity, from which a fold of mucous membrane, previously described by other authors, extends to the tendon of the *tensor tympani* muscle. This projection appears in plastic casts as a fissure extending across the front. The bony ridge was indicated on all the preparations by such a furrow, while the duplicature of the mucous membrane seemed to be absent now and then. Immediately backward of this ridge begins the *aditus ad antrum*. Interesting is also the description of a specimen on which could be recognized an uncommonly large *bulbus venæ jugularis*, in connection with which the author takes occasion to call to mind the paper of Moos on the origin of subjective noises and hallucinations of

hearing (ARCH. OF OPHTH. AND OTOL., vol. iv.). In Bezold's specimen there seems to have been present, besides the enormous dilatation of the bulbus, also a dehiscence of the floor of the drum cavity, and the author points out the possibility that in such cases the wall of the vein might come in direct contact with the membrane of the fenestra rotunda, and thus immediately convey the blood murmur to the labyrinth. On page 40 we find a table containing the dimensions of the drum cavity, the aditus ad antrum, and the cellular spaces. The first part of the paper closes with a résumé of the relative positions of the middle ear cavities toward each other and the auditory meatus, and with a chapter on the remaining pneumatic spaces.

The second part, *which treats of the casts obtained from specimens deprived of their soft parts*, begins also with directions for making them. In the casts of the bones prepared in this way, the spongy spaces appear as delicate, moss-like tresses, from which the pneumatic spaces are easily distinguished by their size, rounded form, and darker color; the compact bone, of course, leaving nothing but lacunæ. In this way the distribution of the various kinds of bone-tissue can be accurately followed, and, in connection herewith, the author calls to mind that the occurrence of partly carious, partly necrotic, processes in the petrous bone is dependent on this anatomical relation. For instance, diseases of the mastoid process give rise to necrotic processes, besides caries, far more frequently than is generally assumed, because the pneumatic spaces of the mastoid process are surrounded by an envelope of compact bone. An osseous nucleus, which required for its solution the repeated employment of hydrochloric acid, was found by the author, in most specimens, in the solid angle of the semicircular canals, as well as in the depth behind the internal meatus. This result completely accords with the peculiar modification of the osseous tissue in the pyramid of the temporal bone, described by S. Moos and the Reviewer, in volume ix., of these ARCHIVES.

Next follows the description of the complete plastic cast of the interior of the bone, made after the removal of its soft parts by maceration. Of this part we only wish to point out the fact, that in none of the preparations were pneumatic cells found in the vertical portion of the squama above the temporal line; in the most anterior horizontal part of the squama, above and in front of the glenoid fossa; in the interior half of the auditory canal; in the immediate surroundings of the labyrinth; and, as a rule, in

the inner third of the pyramid; of the cells of the mastoid part, those in the immediate neighborhood of the auditory canal, are the smallest and most strongly flattened; the cells increase in size in the middle of the mastoid part, and attain their greatest dimensions all around its periphery. Where the *fissura mastoideosquamosa* has been preserved, it appears in the cast as a thin leaf. The pneumatic cellular spaces of the pyramid, on an average, are smaller and flatter than those of the mastoid part. A table on page 60 gives the dimensions of the complex of cells in the plastic cast. We must refer to the original for a more exact study of these dimensions which are of importance, especially in reference to the position of the transverse sinus. As regards the functional importance of the pneumatic spaces of the temporal bone, the author expresses the opinion that their possible advantages are far exceeded by the disadvantages attributable to them as conductors of pathological processes. This is true, both of the purulent and of the catarrhal processes, because on occlusion of the tube, rarefaction of the air by absorption of its oxygen occurs not only in the middle ear, but also in all the pneumatic spaces which represent so large a surface, and thus congestion of the vessels of the mucous membrane is conveyed likewise to more distant regions. Bezold furthermore calls attention to the fact, that the largest pneumatic cells are situated at the periphery—that is, at the greatest distance from the central cavities of the middle ear—a condition extremely unfavorable for the escape of secretions, as well as for their absorption. Abscesses in the large pneumatic spaces at the lower surface of the mastoid process occasionally discharge their contents behind the muscles there inserted; Bezold, as is well known, called attention to this possibility in another publication.

The last pages furnish us the explanation of the casts of the infantile temporal bone, from the new-born to children three years old. The mastoid antrum is investigated with especial thoroughness as regards its form, size, and situation. Finally, in reference to the illustrations, which are reproduced from photographs of preparations in life-size, it is very much to be recommended to examine them through a strong lens. Thereby the finding of the minute details is not only greatly facilitated, but the forms, as it were, project plastically from the plane, and we cannot repress the idea that a stereoscopic photograph of such preparations must be of advantage for their study. We conclude with the wish that this thorough, and, in

anatomical and practical respects, equally valuable work, may find a large circle of readers.

Die acute Entzündung des häutigen Labyrinthes des Ohres (Otitis Labyrinthica S. Intima) irrthümlich für Meningitis cerebro-spinalis gehalten. Für practische Aerzte dargestellt von Prof. Dr. R. VOLTOLINI, in Breslau. Breslau: E. Morgenstern, 1882. Reviewed by Arthur Hartmann, Berlin.

In the present monograph Voltolini aims at proving that the disease first described by him as otitis labyrinthica is usually erroneously diagnosed as epidemic meningitis. Voltolini's demonstration, we shall premise, culminates in this, that the loss of hearing of 187 deaf-mutes who were brought to him was, in his opinion, caused by otitis labyrinthica, and that he believes that in these cases he can exclude an abortive form of cerebro-spinal meningitis. In order to prove the great importance of the disease, Voltolini cites from a report of the Breslau Institute the statement that about fifty per cent. of the inmates became deaf in consequence of cerebral affections. Voltolini's logic, then, is this: "If otitis labyrinthica furnishes to me, a practical otologist, a greater contingent than all other diseases, I can safely assert that otitis labyrinthica furnishes the largest contingent to the deaf-mute institutions, for the otologist sends these deaf-mutes to those institutions." The Breslau report comprises the years 1869 to 1878, a period in which, as Voltolini emphasizes, no epidemic of cerebro-spinal meningitis prevailed in any part of Germany. This, indeed, is correct. But Voltolini overlooks that it is just during the period mentioned that the children who had become deaf during the great epidemic of cerebro-spinal meningitis in the years 1863-1865 would be required to enter school. Especially because we know that in Breslau the children are sent to school later than elsewhere.

Voltolini believes that the proportion in the Berlin deaf-mute institute [the royal institution is meant—REV.] is similar to that of Breslau, because here likewise a very large number is reported as deaf in consequence of cerebral affections. As no cerebro-spinal meningitis prevailed, Voltolini puts the question: "What remarkable 'inflammation of the brain' could it have been that caused so many children to become deaf?" The Reviewer takes the liberty of replying that the "remarkable inflammation of the brain" was the simple non-epidemic basilar meningitis, which seems to be altogether unknown to Voltolini. It so happens that the Reviewer possesses accurate data in reference to the deaf-

mates in the royal institution at Berlin, and he can assert positively that at present there is not one among the pupils who has become deaf in consequence of otitis labyrinthica. Almost without exception, as we shall show more fully in the next number of these ARCHIVES, the diseases were grave and of long duration, and leave no room for doubt that they were meningitis.

Of the 187 cases which came under Voltolini's observation from various countries in the years from 1853 to 1881, thirty-six belong to the years 1863, 1864, 1865; forty to the years 1870, 1871; eighteen to the year 1879, while but few cases were observed in the remaining years. Voltolini says: "It would be an erroneous conclusion if one were to attempt to invalidate my deduction by saying that it appears from my above figures that (for instance, in 1879, when an epidemic of meningitis prevailed in Silesia or Breslau) many cases of the disease which I call otitis labyrinthica occurred at the same time (18); it would be an erroneous conclusion, for we learn, on the other hand, from the same table that in the years 1870 and 1871 twenty cases each—that is, even more than in 1879—came under my observation when no epidemic prevailed!" Here Voltolini is in error, for in the years 1870 and 1871 epidemics prevailed in various parts of Germany, especially here in Berlin ("Comp. Jahresberichte von Virchow and Hirsch für 1871," Bd. ii., p. 201). The period during which the greater number of cases came under observation coincides, therefore, so closely with the time of the epidemics, that Voltolini will probably not charge us with a lack of logic if we assert it appears from Voltolini's table that in a large number of his cases epidemic cerebro-spinal meningitis must have been present.

Voltolini subsequently groups together the symptoms by which his otitis labyrinthica is to be distinguished from cerebro-spinal meningitis leading to deafness. With regard to the most important characteristic of cerebro-spinal meningitis, Voltolini says: "Persistent dizziness and staggering gait are not prominently mentioned by any writer," while after otitis labyrinthica, staggering gait and vertigo remain without exception for months and even years. Here again Voltolini is in error, inasmuch as all writers who have treated at some length of the deafness occurring with cerebro-spinal meningitis, lay stress on the fact that vertigo and a staggering gait are associated with the deafness.

As Voltolini assumes that this symptom is so characteristic "that we can say at once, when seeing such a child: it has suffered from otitis labyrinthica some time ago," we might likewise assume that many of his diagnoses are based on this error.

That Voltolini is not over-scrupulous in his diagnoses, appears from the notes of the fifty-one cases cited. The first case reads literally: "1. Otto F., from Greissen, in Thuringia, almost absolutely deaf, had become so in 1856 by some affection of the head, that is, most probably by otitis labyrinthica; was examined by me in 1862, and the examination showed no other abnormality. I enumerate the case because it happened far away from Silesia." The statement that the child had become deaf by some disease of the head is sufficient for Voltolini to number it among his 187 cases of otitis labyrinthica. In several of the cases nothing is stated but that the child became deaf. In a larger number of the cases cited more in detail, dating from a later period, the symptoms are far more characteristic of meningitis than of otitis labyrinthica.

Voltolini finds a material support for his view in the fact that, in none of the cases observed by him, other nervous regions were affected. The Reviewer cannot regard this as positive evidence, for, in the large majority of persons deaf from meningitis, who come under observation in deaf-mute institutions, an affection of other nervous regions is not met with.

Voltolini believes that otitis labyrinthica cannot be confounded with sporadic meningitis, because the latter, according to Niemeyer, as a rule is confined to the convexity. Here, too, Voltolini is in error, inasmuch as the acute form of sporadic basilar meningitis occurs both in adults and in children. In this respect we refer to a more competent authority, Huguenin (Ziemssen's *Cyclopædia*, "Diseases of the Nervous System," first half).

A great deal more might be said about Voltolini's book. The Reviewer, however, believes he can confine himself to some of the main points. Although the occurrence of otitis labyrinthica in Voltolini's sense is not to be disputed, especially since Politzer confirmed its occurrence by a post-mortem examination, attention must nevertheless be called to the fact that the foundations of Voltolini's views are largely based on error. By the book under review, with its errors corrected, as well as by the experience of all other observers, the conviction is forced upon us that the disease occurs by no means with the frequency which Voltolini seeks to demonstrate.

Student's Manual of Diseases of the Nose and Throat.

By J. M. W. KITCHEN, M.D., G. P. Putnam's Sons 1883.
Price \$1.00

A very handy, beautifully printed compendium of 124 duodec-

imo pages, with numerous engravings. It may serve to the beginner as an introduction—first steps—in a very important branch of the healing art. It begins with an (incomplete) anatomical résumé, describes and depicts on ten pages the instruments for diagnosis and treatment, on eight pages the principal remedies, on seventeen pages the “manipulative methods” of examination, local application of remedies, and operations, on forty pages the common disorders of the nasal fossæ and pharynx. The remainder is devoted to the diseases of the larynx. The book, though short, presents the subject in a comprehensive and attractive manner, and contains, even for the adept, many a useful hint. H. K.

Guide to the Study of Ear Disease. BY P. McBRIDE, M.D., (Edinburgh): W. & A. K. Johnston, Edinburgh, 1884.

We just receive this new treatise of 198 octavo pages with seven colored and three lithographic plates. We regret that the closing of the present number of the ARCHIVES has not left us time to read the book carefully enough to form a competent opinion, but we will not delay calling the attention of our readers to this very neatly gotten up volume the usefulness of which is guaranteed by the well-known name of the author. The arrangement of the first two-thirds of the book, does not deviate materially from that of other text-books. In the last third some special subjects are described with more than ordinary detail, viz.: the disturbance of the nervous system resulting from ear disease, *e. g.* anomalies of taste, epilepsy, vertigo, etc. Tinnitus aurium is very fully discussed. Particularly important appears the last chapter: Diseases which effect the ear:—scarlatina, mumps, typhoid, cerebro-spinal meningitis, malaria, syphilis, locomotor ataxia, and many others. H. K.

MISCELLANEOUS NOTES.

The eighth session of the INTERNATIONAL MEDICAL CONGRESS will be held at Copenhagen, from August 10 to 16, 1884. Dr. V. Meyer is the president of the organizing committee for the section of otology, Dr. V. Bremer the secretary.

The meeting of the BRITISH MEDICAL ASSOCIATION will be held at Belfast, Ireland, from July 29 to August 1, 1884. There will be a sub-section on otology.

The THIRD INTERNATIONAL OTOLOGICAL CONGRESS will be held at Basel, Switzerland, from Sept. 1 to 4, 1884. Organization Committee: Drs. Burckhardt-Merian, (President); Hartmann, Löwenberg, Ménière, Politzer, Sapolini, Dalby, Pritchard, Blake, and Roosa.

The meeting of the AMERICAN OTOLOGICAL SOCIETY will be held at the Kaaterskill House, Catskill Mountains, July 15, 1884. President: Dr. C. H. Burnett.